

National Pipeline Mapping System (NPMS)

*Standards for the
NPMS National and
State Repositories*

March 1999



prepared by the

U.S. Department of Transportation



Office of Pipeline Safety
400 7th Street, S.W.
Washington, D.C. 20590
www.npms.rspa.dot.gov

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List of Acronyms

AA.....	anhydrous ammonia
AML	Arc Macro Language
ASCII.....	American Standard Code for Information Interchange
Baker.....	Michael Baker Jr., Inc.
CAD.....	computer-aided drafting
CD.....	compact disk
CD-ROM.....	compact disk-read only memory
COTR.....	Contracting Officer's Technical Representative
CO ₂	carbon dioxide
CRD	crude oil
ESRI.....	Environmental System Research Institute
FTP (site)	file transfer protocol site
FGDC.....	Federal Geographic Data Committee
GIS.....	geographic information systems
HDM.....	Harvard Design and Mapping
HG.....	hydrogen gas
HVL.....	highly volatile liquid
LNG	liquefied natural gas
LPG.....	liquefied petroleum gas
MQAT II.....	Joint Government/Industry Pipeline Mapping Quality Action Team
NAD 27, 83.....	North American Datum (of 1927 or 1983)
NG.....	natural gas
NGL	natural gas liquids
NPMS	National Pipeline Mapping System
ODE.....	Open Development Environment
OPS	Office of Pipeline Safety, U.S. Department of Transportation
PRD.....	product
QA/QC.....	quality assurance/quality control
QC Team.....	Quality Control Team
RMS.....	root mean squared error
RSPA	Research and Special Programs Administration, U.S. Department of Transportation
USDOT.....	U.S. Department of Transportation
USGS	United States Geological Survey

Preface

This document was prepared by the second Joint Government/Industry Pipeline Mapping Quality Action Team (MQAT II). The team was sponsored by the U.S. Department of Transportation's (USDOT) Office of Pipeline Safety (OPS), American Petroleum Institute (API), American Gas Association (AGA), and Interstate Natural Gas Association of America (INGAA). Representatives on the team included the OPS; Bureau of Transportation Statistics (BTS); U.S. Department of Energy (USDOE); U.S. Geological Survey (USGS); Federal Energy Regulatory Commission (FERC); state representatives from California, Louisiana, New York, and Texas; and representatives from the pipeline industry.

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Federal Geographic Data Committee – www.fgdc.gov

Office of Pipeline Safety – ops.dot.gov

Research and Special Programs Administration – www.rspa.dot.gov

U.S. Department of Energy – www.doe.gov

U.S. Department of Transportation – www.dot.gov

U.S. Geological Survey – www.usgs.gov

National Pipeline Mapping System

NPMS Repositories

National Repository

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1. Introduction

The standards for the National Pipeline Mapping System (NPMS) National and state repositories were created with input from federal and state government agencies and the pipeline industry. They address and describe how the National Repository and state repositories collect, process, exchange, distribute, display, and store data. The NPMS will contain natural gas transmission pipelines, liquid and product trunk pipelines, and liquefied natural gas (LNG) facilities data. The goal is to construct a seamless, digital database of pipelines and LNG facilities in the United States and to make this information available to government agencies, pipeline facilities, operators, and the public.

The NPMS National Repository collects and maintains the NPMS national database on behalf of the Office of Pipeline Safety (OPS). NPMS state repositories, in cooperation with the National Repository, are responsible for maintaining and collecting data for their states. For those states without a state repository, the National Repository will maintain the data.

This volume governs how repositories process and manage data. It is a companion to the *Operator Standards* manual, *National Pipeline Mapping System: Standards for Pipeline and Liquefied Natural Gas Operator Submissions*.¹ Repository personnel should be fully familiar with the *Operator Standards*. Terms and conditions defined in the *Operator Standards* apply equally to these (repository) standards.

1.1 NPMS Repository Model

The NPMS consists of multiple state repositories and a single National Repository, which must work in partnership to maintain the system. NPMS repositories will receive data from operators, either in digital or hard-copy format, and process the data. Processing data will include notifying operators of receipt of data, performing a quality control review, digitizing or digitally processing the geospatial elements, defining and relating the attribute data, and incorporating the metadata.

Each repository is responsible for establishing and maintaining version control in conjunction with the National Repository, and maintaining archives of all processed data. Each repository is also responsible for working directly with the operator on matters of quality control, attribute errors, and missing items or information.

The state repositories will process the information for pipelines and LNG facilities within their state boundaries, and the National Repository will process

¹ In this manual, the operator standards manual will be referred to in italics as the *Operator Standards*.

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the information for all other states. The National Repository will also serve as the final processing and storage facility for all NPMS data, and will provide the final quality control review.

State repositories must collect, process, and store all data elements defined in these standards. However, serving as a state repository does not preclude a state from collecting more data than is required by NPMS. If a state has the regulatory authority, it may request positional accuracy that exceeds NPMS standards, or it may require additional data, such as gathering lines, distribution lines, pressure, and valve locations. States must remove non-NPMS standard data, including non-transmission lines, prior to forwarding data to the National Repository.

When specifically requested by an operator, state repositories should also remove data that is optional for an NPMS submission prior to forwarding the data to the National Repository. For example, California requires operators to submit diameter; however, diameter is an optional field in the NPMS. Therefore, operators submitting data to California may request that diameter not be forwarded to the NPMS National Repository. Optional fields, such as diameter, should be sent to the National Repository unless the contributing operator specifically requests that it be withheld.

Operators will submit their data according to rules established in the *Operator Standards*. Those rules allow operators whose facilities pass through multiple states to submit digital data (not hard-copy) directly to the National Repository to ease the burden of having to divide digital data into multiple data sets. In such cases, the National Repository will process the submitted digital data and provide the processed data to the appropriate state repositories. The state repository will be responsible for contacting the operator and collecting any additional information the state may require.

1.2 NPMS Submission Data Flow

Exhibit 1 shows an eight-step process in which submissions will pass from pipeline and LNG facility operators, through state repositories or National Repository processing, to quality control and final incorporation into the NPMS database.

1. **Operator Submission.** The process will start when an operator sends information (termed “submission”) to an NPMS repository.
2. **Repository Check-In.** Repositories will log, scan digital submissions for viruses, inventory submissions, notify operator of submission receipt, and initiate tracking procedures. Tracking will be a cooperative effort between the state repositories and the National Repository.

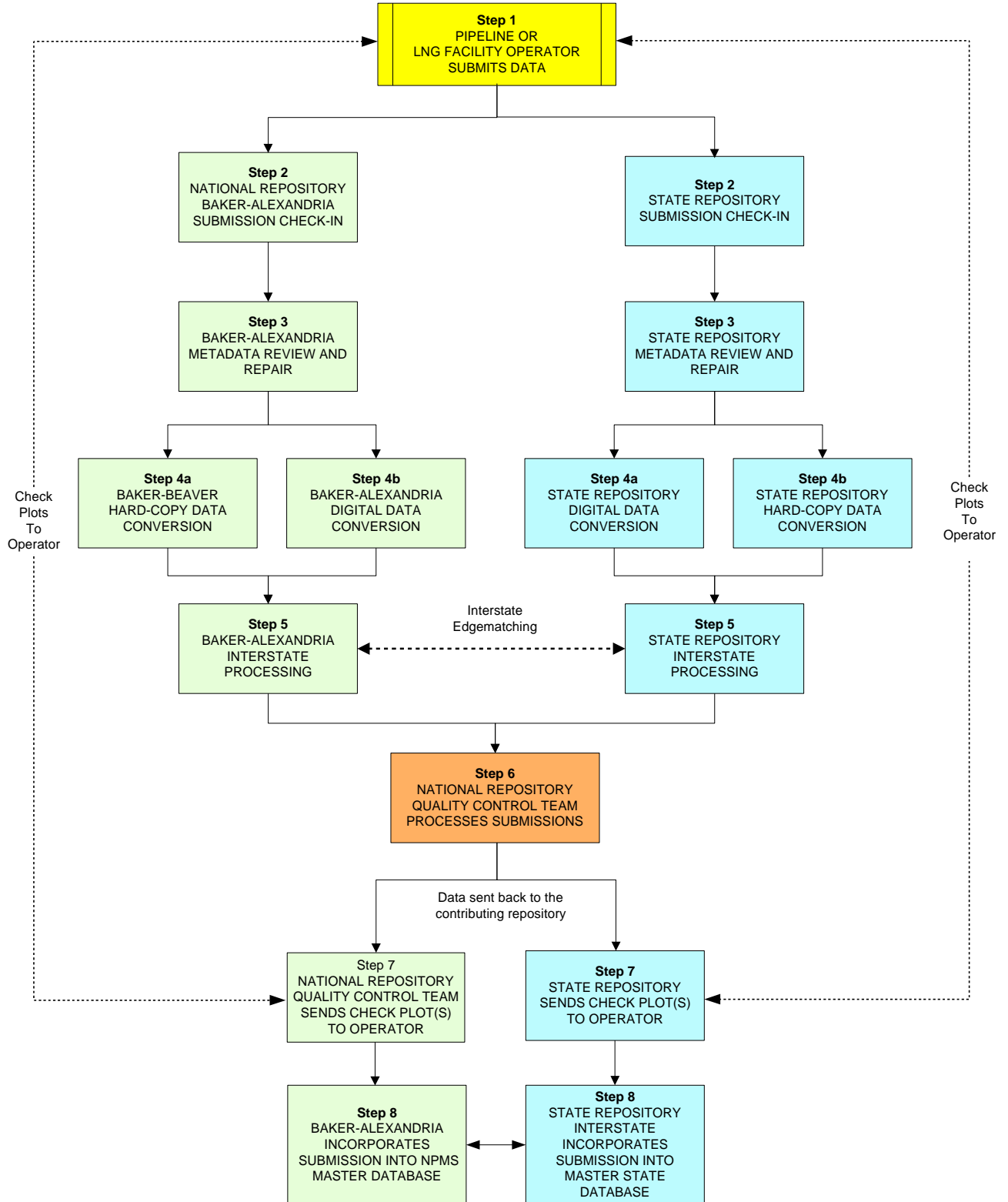


Exhibit 1. Eight-step NPMS data submission process.

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3. **Metadata Review and Repair.** The metadata file(s) that accompanies a submission is extremely important because it serves as a transmission form as well as the metadata. Various NPMS applications, particularly the *Geospatial Data Conversion Tool*, will depend on information from the metadata to complete processing in an automated manner. If problems exist with the metadata, repositories will work with the operator to complete the submission. The submission will then be routed for the necessary processing.
4. **Hard-Copy and Digital Data Conversion.** Submissions with hard-copy geospatial data will be separated from submissions with digital geospatial data. Hard-copy submissions will be digitized, and digital submissions will be translated. Attribute data will be matched to the appropriate line features and reviewed for compliance with the standards. At the end of this step, the data will be in ARC/INFO format and ready for final processing.
5. **Interstate Processing.** The state repositories and the National Repository will work together to assign NPMS_SYS_IDs and coordinate interstate edge-matching, completing the final processing. States that collect more data than the NPMS requires, or that have a different storage scheme, must bring their data into compliance with national standards at this stage.
6. **Quality Assurance and Quality Control.** An independent quality control review will be performed by the National Repository Quality Control Team.
7. **Operator Check Plot Review.** The repository that originally received the submission will prepare a random selection of check plots for review by the submitting operator. The operator will be asked to review and comment on the check plots. The National Repository intends to distribute check plots via an Internet map server application. State repositories will be free to distribute check plots by the most appropriate means.
8. **Incorporation of the Data into the Master State or National Database.** The repositories will incorporate the data into their master database. If the submission was originally sent to the National Repository, the state may have to collect additional information to meet its requirements at this time.

1.3 Working with Pipeline and LNG Facility Operators

Contribution of data by pipeline operators to the NPMS is voluntary (except where mandated by state regulations). The overall success of the NPMS program depends on gaining and maintaining the enthusiastic participation of operators. Therefore, building and maintaining a cooperative partnership with pipeline operators is a paramount responsibility of the NPMS repositories.

Working with operators is to be an interactive, helpful process – meaning repositories should contact and interact with operators via telephone discussions or e-mail correspondence.

If there is a problem with a submission, the repository shall make a reasonable effort to resolve the problem by contacting the submitting operator. For example, assume an operator forwards a submission that is missing or employs an obviously wrong OPS_ID. The repository should research and identify the correct OPS_ID and then contact the operator inquiring, “*The repository believes your firm’s OPS_ID is 12345. Is that correct?*” Only as a last resort should an operator be told that the submission is “incomplete,” “unacceptable,” or “inadequate” and that it must be redone.

While interacting with operators, the following standards are to be maintained at all times:

- ◆ Operators will be treated in a professional and courteous manner.
- ◆ Phone calls from operators will be returned within two business days.
- ◆ E-mail correspondence from operators will be answered within five business days.
- ◆ Written correspondence from operators will be answered within 10 business days.
- ◆ Operator requests for NPMS data (if in compliance with NPMS Data Dissemination Standards, see Section 5) will be processed within 10 business days.
- ◆ Data submitted by operators that does not meet NPMS specifications will not be rejected outright. Rather, the following procedures shall be adhered to:
 - The repository will attempt to correct obvious errors and omissions. The operator may be contacted by telephone or e-mail as part of this process.
 - If unsuccessful, the operator will be sent a letter requesting a resubmission according to the NPMS standards within 30 days.
 - If after 30 days the operator is unable or unwilling to comply with the NPMS standards, a copy of the submission will be forwarded to the OPS for review. The OPS will provide further instructions for handling the non-compliant submission.
- ◆ Complaints and comments from operators will be tracked and, when appropriate, acted upon.
- ◆ Incidents where an operator becomes seriously agitated (for example, yells at a repository staff person) or where a repository makes a serious error (for example, loses or damages a submission), shall be reported via e-mail to

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the OPS Contracting Officer's Technical Representative (COTR) within three business days. The report shall include contact information for the operator. When appropriate, the OPS will contact operators directly to handle significant misunderstandings or to mitigate disputes.

1.4 National Repository Contacts

Michael Baker Jr., Inc. (Baker) will operate the National Repository with assistance from the Environmental System Research Institute (ESRI) and Harvard Design and Mapping (HDM). The National Repository will be located in Baker's Alexandria, Virginia, office. The Alexandria office will manage the repository, including contacts with state repositories, process all digital submissions, and store and maintain the NPMS server with the complete national data set. Baker's Beaver, Pennsylvania, office will manage the digitizing of hard-copy submissions. ESRI will provide software and consulting support, and HDM will perform quality control reviews on all NPMS data, including data processed by state repositories.

1.5 Key Terms and Definitions

The NPMS repository model is based on the management of operator submissions. Therefore, it is critical that repositories have a common understanding of the term "submission" and of the procedures that will be used to name and track submissions.

Submission – A submission occurs when an operator sends a repository information with the intent of adding to or updating the NPMS database. A submission includes all substantive submission items sent by the operator to the repository. Items may include correspondence (hard-copy or e-mail), phone call logs, diskettes, digital files, and/or hard-copy map sets.

Every NPMS submission, whether initially sent to a state repository or to the National Repository, will be assigned a SUBMISSION_ID. Submission identification numbers are issued exclusively by the National Repository. The SUBMISSION_ID will be generated and registered by entering the repository section of the NPMS Web Site and completing a brief form. The SUBMISSION_ID is a 13-character field created as follows: (The 13 characters will accommodate the maximum length for the name of an ARC/INFO coverage.)

Repository code + hyphen + OPS_ID + hyphen + 4-digit sequence number

A typical example of a submission identification number follows:

SUBMISSION_ID = TX-12345-0001

Exhibit 2 lists the two-character alpha codes for each state repository.

Two-Character Alpha Code	State Repository
CA	California Repository
KS	Kansas Repository
KY	Kentucky Repository
LA	Louisiana Repository
MN	Minnesota Repository
NR	National Repository
NJ	New Jersey Repository
OK	Oklahoma Repository
PA	Pennsylvania Repository
TX	Texas Repository

Exhibit 2. State repositories' two-character alpha identifiers.

OPS_ID (five-digit, numeric). This is the identification number assigned by the OPS pipeline and LNG facility operators, and is five digits or fewer. In cases where an OPS_ID is fewer than five digits, leading zeros will be used.

Sequence number (four-digit, numeric). The default sequence number is 0001. The next submission by that operator will be assigned by the sequence number 0002.

Every submission will be assigned a SUBMISSION_TYPE. There are seven types of NPMS submissions as defined by the *Operator Standards*:

1. **Additions.** Additions contain **only** data that is new to the NPMS. All original submissions are additions. All additions should contain geospatial data, attribute data, and metadata. The revision codes (REVIS_CD) of all pipeline segments should be set to "A" for addition.
- 2–4. **Modifications.** Modifications should include **only** modified data. There are three types of NPMS modifications. Operators should inform the repository of the type of modification being made.
 2. A **geospatial modification** is used if location data or location and attribute are to be modified. All geospatial modifications should contain geospatial data, attribute data, and metadata. The revision codes (REVIS_CD) of all pipeline segments and/or LNG facilities should be set to "M" for modification or "D" for deletion.
 3. An **attribute only modification** is used if modifications only affect pipeline or LNG facility attributes. Attribute only modifications should contain attribute data, metadata, and a letter identifying the affected pipeline systems (SYS_NM) or individual pipeline

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- segments. The revision codes (REVIS_CD) of all pipeline segments and LNG facilities should be set to “M” for modification.
4. A ***metadata only modification*** is used if modifications only affect metadata. This might include a name change of the technical contact. Metadata only modifications should contain a complete replacement metadata file, and a letter identifying the affected pipeline systems (SYS_NM) or individual pipeline segments.
 5. **Change of Operator Report.** The operators of any given pipeline system may change frequently. When this occurs, both the old and new operator of the pipeline system should report the change using the NPMS Web Site or send correspondence. Repositories will confirm the changes and update the NPMS mailing list.
 6. **Update Contact Information.** To report name changes, address changes, or updates to other operator contact information, send a letter or e-mail to an NPMS repository, or connect to the NPMS Web Site and update the contact information online. Include your firm’s OPS_ID in all correspondence. Repositories will confirm the changes and update the NPMS mailing list.
 7. **Change Pipeline System Status.** If any entire pipeline system operates sporadically or the transported commodities change, NPMS should be notified via the NPMS Web Site or by correspondence. For example, a change occurs when an operator notifies a repository that a pipeline system has been taken in or out of service, has been abandoned or retired, or if the commodity(ies) carried has changed.

2. Repository Computing and Communication Guidelines

2.1 Hardware and Software Guidelines (Optional)

The National Repository has adopted hardware and software standards. State repositories are encouraged to adopt the same standards in order to facilitate the sharing of data and customized applications. However, adherence to the computing standards is optional.

Software customization (macros, Open Development Environment [ODE], Arc Macro Language [AML], and Avenue programs, etc.) developed by the National Repository with U.S. Government funds will be made available to the state repositories. Additional customization may be required for operation on state hardware or for compliance with state standards. Likewise, programs/customizations developed by state repositories with U.S. Government funds shall be made available to other state repositories and to the National Repository.

The National Repository and OPS will determine the schedule and scope of automation based on available funding and the projected volume of processed submissions. Exhibit 3 lists the NPMS hardware and software standards.

Hardware / Software Requirements	Manufacturer / Vendor
Hardware platform	Intel
Operating system	Windows NT 4.0 or higher
Geographic information systems (GIS) data processing	ARC/INFO 7.2.1 or higher
Hard-copy digitizing	MicroStation SE or higher
GIS front end	ArcView 3.1 or higher
Database front end	Microsoft Access 97 or higher
Database back end	Oracle 8.0 or higher
Vector compression	WINZIP or PKZIP
Raster compression	MrSID, JPEG
Internet map server	MapObjects IMS

Exhibit 3. NPMS hardware and software standards.

2.2 Internet Access Capabilities

Every NPMS repository should have Internet e-mail, Web, and file transfer protocol (FTP) access. Moreover, state repositories are strongly encouraged to have their own Web sites with links to all other repositories and to the OPS.

In addition, every repository is requested to have a dedicated e-mail address. This address should be associated with a repository as a whole and not with any

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particular individual. The National Repository's e-mail address is *npms-nr@mbakercorp.com*.

2.3 Inter-Repository Data Exchange Standards

All inter-repository data exchanges shall take place in the following medium types, formats, and parameters.

2.3.1 Transmission Medium Types

Routine transmissions between state repositories and the National Repository shall be made using interfaces provided on the NPMS Web Site.

Other transmissions between repositories shall be via e-mail and e-mail attachments. Files larger than one megabyte shall be sent via FTP with e-mail notification. State repositories and the OPS will have addresses and dedicated directories on the National Repository FTP Site. The National Repository FTP Site may be used for state-to-state as well as state-to-national file transfers. Compact Disk–Read Only Memory (CD–ROM) or Iomega Zip disks will be the standard for extraordinarily large data transfers.

2.3.2 Geospatial, Attribute, and Metadata Formats and Parameters

Geospatial and attribute data shall always be sent with the associated metadata. Metadata shall be exchanged in Microsoft Access (.MDB) format. ARC/INFO's interchange format (.E00) is the preferred data exchange format for geospatial and attribute data. ArcView shapefiles (.SHP, .SHX, .DBF) are the secondary data exchange formats. WINZIP or PKZIP shall be the programs used for compression. If using UNIX, employ the "unix2dos" command prior to compression. All geospatial data shall be double precision. The projection parameters shall be set to:

Projection	Geographic
Datum	NAD83
Zunits	None
Units	DD
Spheroid	GRS1980
Xshift	0.0000000000
Yshift	0.0000000000

2.3.3 File-Naming Conventions

All NPMS repositories must have systems that accept long file names. Inter-repository data transfers will consist of two files, an ARC/INFO .E00 file containing the geospatial and attribute data and a Microsoft Access .MDB file containing the metadata. The file names will be the SUBMISSION_ID and the appropriate extension. For example:

TX-12345-0001.E00
TX-12345-0001.MDB

3. The NPMS's System Design and Functionality

The National Repository will develop a series of computer applications to manage the NPMS's technical and administrative functions, including interactions with the state repositories. The timeframe for tool development will be determined by the OPS and the National Repository based on available resources and anticipated demand. The tools will be made available to state repositories as they reach the Beta stage in the development cycle.

- ◆ The *NPMS Metadata Template* (Visual Basic) has been developed to allow pipeline and LNG facility operators to submit metadata and basic transmittal information to repositories. Repositories can use the tool to edit metadata.
- ◆ The *NPMS Attribute Template* (Visual Basic) has been developed to assist operators with creating and submitting digital attribute data. Repositories can use the tool to edit data that have been created with the tool. The tool is intended only for those operators who do not already have digital attribute data.
- ◆ The *NPMS Master Database* (Oracle) will be the primary tool for storing NPMS attribute data, metadata, submission tracking data, operator data, and administrative data. The only major part of the NPMS that will be stored outside of the master database is the geospatial data, which will be stored and manipulated in the ARC/INFO environment.
- ◆ The *NPMS Web Site* will operate a multi-purpose Web site, www.npms.rspa.dot.gov. Functions of the site will include dissemination of information to the general public, operators, state repositories, and the OPS. The site will also manage transactions between operators and state repositories. **For the OPS, state repositories, Baker-Beaver, and HDM, the NPMS Web Site will provide a crucial link to the National Repository (Baker-Alexandria) and the NPMS master Oracle database that tracks the NPMS project.**
- ◆ The *Submission Management Tool* (customized Microsoft Access or Web-based, front end; Oracle, back end) will be developed and will perform several functions. It will assist repository technicians with checking in submissions, managing the inventory of submission items, reviewing and manipulating submission metadata, and translating attribute data.
- ◆ The *Geospatial Data Conversion Tool* (ArcView, front end; ARC/INFO, back end) will assist technicians with data translation, projection, edge-matching, manipulation, and quality review. Appendix A contains a technical description of the *Geospatial Data Conversion Tool*.
- ◆ The *Quality Control Team Automated Screening Application* (ARC/INFO, AML, or ODE) will support the quality control effort by performing a wide variety of tests on data from repositories and will report the results.

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3.1 The NPMS Web Site, Key Functionality

The NPMS Web Site will be divided into six sections. Each section will have a specific set of functions and access privileges.

3.1.1 The Welcome Section

This section will be available to the general public and will

- ◆ present a general overview of the NPMS project,
- ◆ direct users to other sections of the NPMS Web Site,
- ◆ provide current contact information for the National Repository and state repositories,
- ◆ provide a section on new information for public updates, and
- ◆ offer links to NPMS-associated Web sites. Links will include the home pages of the OPS, state repositories (where available), other federal agencies (as applicable), relevant associations (e.g., American Gas Association, etc.), and Baker.

3.1.2 The NPMS Data Dissemination Section

This section will be available to the general public and will provide

- ◆ a more detailed description of the NPMS process;
- ◆ a more detailed description of NPMS data, including Federal Geographic Data Committee (FGDC)-compliant metadata for the NPMS as a whole;
- ◆ statistics (updated monthly) on the number of pipeline miles included in the NPMS, the number of submissions processed, etc.;
- ◆ an explanation of NPMS data dissemination rules;
- ◆ a way to download NPMS data in common formats;
- ◆ a fee schedule for NPMS data based on mileage, media, and shipping methods requested; and
- ◆ an interface to request NPMS data.

Also, subject to the discretion of the OPS, this section could provide

- ◆ a MapObjects Internet Map Server providing NPMS data to the general public and
- ◆ a capacity to process credit card payments for plots and/or digital data.

3.1.3 The Operator Section

This section will be available to operators and the general public and will provide

- ◆ an NPMS news page for operators,

- ◆ a downloadable (.PDF) version of the NPMS *Operator Standards*. (In addition, an interactive Web version of the *Operator Standards* may be produced.),
- ◆ the downloadable *NPMS Attribute and Metadata Template*,
- ◆ a method for operators to determine their OPS_IDs,
- ◆ a method for operators to request an OPS_ID (or link to an OPS site, which performs that function),
- ◆ an interface form transmitting all digital submissions on-line to the National Repository,
- ◆ a method for operators to verify whether or not a given pipeline system is currently in the NPMS and view the metadata for that system,
- ◆ a method for operators to identify the status of their submission,
- ◆ an on-line interface for operators to report new NPMS contact information (contact name, phone number, e-mail address, etc.). (If a change is reported, the National Repository will send a change confirmation to both the old and new contact prior to updating the master NPMS master database.), and
- ◆ an on-line interface for operators to report a staff operator change for a given pipeline system or portion of a pipeline system.

3.1.4 Check Plot Section

This section will be used only by the National Repository. It will be open only to operators who have received a coded URL address that was sent to them by HDM and will provide

- ◆ check plots² made available on-line using MapObjects Internet map server,
- ◆ an interface allowing the operator to submit comments and/or mark problem areas on the map, and
- ◆ an interface allowing the operator to request transmission of his/her submission in a variety of digital vector formats for free via e-mail.

3.1.5 The Repository Section

Use of this section will be open to the OPS and repositories. The section will provide

- ◆ an NPMS news page for repositories,
- ◆ a downloadable (.PDF) version of these (repository) standards,
- ◆ an interface for assigning new SUBMISSION_IDs,
- ◆ an interface for assigning new NPMS_SYS_IDs,
- ◆ a reporting interface where repositories submit monthly reports,

² Check plots will show only one submission at a time.

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- ◆ an interface for transmitting processed submissions on-line to the National Repository, and
- ◆ an interface for repositories to process change of operator reports.

3.1.6 Tracking National Repository Submissions

Use of this section will be open to the OPS and the National Repository only. It will provide a series of interfaces for staff at Baker-Beaver and HDM to track their work on individual submissions. (See Section 8 for details.)

4. NPMS Repository Data Model

Exhibits 4 and 5 display the repository data model for NPMS geospatial, attribute, and metadata. The manner in which repositories will store NPMS data differs in several respects from the manner in which operators will submit data.

4.1 Normalization of Pipeline Data (the NPMS_SYS_ID)

Pipeline data is to be normalized by the pipeline system and an NPMS_SYS_ID is to be assigned to each pipeline system. Data unique to the system is to be placed in the Pipeline System Attribute Table. There will be one record in the Pipeline System Attribute Table for each pipeline system. Attribute data, which may vary by pipeline segment, will be kept in the Pipeline Segment Attribute Table. There is a one-to-many relationship between the Pipeline System Attribute Table and the Pipeline Segment Attribute Table.

The NPMS_SYS_ID will provide a stable and unique identifier for pipeline systems and LNG facilities, which will serve as a common reference for government agencies, NPMS repositories, and operators. The NPMS_SYS_ID will be consistent across state boundaries and will remain the same as pipeline systems are transferred among operators. The NPMS_SYS_ID will be crucial for the later development of future applications based on NPMS data (e.g., incident reporting). The NPMS_SYS_ID will be particularly important for future integration with existing databases at the OPS, including the Integrated Operator Compliance System.

A pipeline system's NPMS_SYS_ID can only change if part of the system is transferred to a new operator. In that case, two new NPMS_SYS_IDs will be assigned and the old NPMS_SYS_ID will be retired. If the entire pipeline system is transferred among operators, the NPMS_SYS_ID will remain the same.

4.2 Metadata Database Tables

When metadata arrives from an operator, it will be in a Microsoft Access database (.MDB) file. (See Appendix B, Database Created by the *NPMS Metadata Template* as Submitted By Operators). Metadata will remain in the Microsoft Access format during processing. During final incorporation of the submission into the NPMS master database, operator contact information will be moved to the master database Primary and Technical Contact Tables. A METADATA_ID will link pipeline systems and LNG facilities to their corresponding records in the Primary Metadata Table.

Geospatial data may have many sources; so there is a one-to-many relationship between the Primary Metadata Table and the Source Material Table.

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LNG Facility Attribute Table

Field Name	Field Type	Field Length	Description (acceptable values in bold)	Required Field (Y/N)
NPMS_SYS_ID	Integer	8	Unique link between the geospatial elements (points) and their respective attribute records. Assigned by National Repository.	Y
OPS_ID	Integer	5	Valid OPS operator identification number.	Y
OPER_NM	Character	40	Name of firm that operates the facility.	Y
LNG_NM	Character	40	Name of facility.	Y
LNG_ID	Character	20	Identifier for the facility assigned by the operator.	Y
STATUS_CD	Character	1	Current status of the facility. I =in service, B =abandoned, R =retired.	Y
QUALITY_CD	Character	1	Positional accuracy of the facility data: (E)xcellent = 0 to 50 feet, (V)ery Good = 51 to 300 feet, (G)ood = 301 to 500 feet, (P)oor = 501 to 1000 feet, (U)nknown.	Y
REVIS_CD	Character	1	Identifies this facility as A =addition to the NPMS, or M =modification to or D =deletion of a previous submission.	Y
METADATA_ID	Character	8	Metadata database record associated with this facility.	Y
SUBREPOS_CD	Character	2	Two-letter code for the repository that processed the data.	Y

Pipeline System Attribute Table

Field Name	Field Type	Field Length	Description (acceptable values in bold)	Required Field (Y/N)
NPMS_SYS_ID	Integer	8	Unique ID for the pipeline system assigned by the National Repository. State repositories connect to NPMS National Repository Web Site to obtain new NPMS_SYS_ID numbers.	Y
OPS_ID	Integer	5	Valid OPS operator identification number.	Y
OPER_NM	Character	40	The name of the company that physically operates the pipeline system.	Y
SYS_NM	Character	40	Assigned by the operator. Name of a single pipeline system.	Y
COMMODITY1	Character	3	Abbreviation for the primary commodity carried by the pipeline system. HG =hydrogen gas, CRD =crude oil, LPG =liquid petroleum gas, NG =natural gas, PRD =product, AA =anhydrous ammonia, CO2 =carbon dioxide, NGL =natural gas liquids, HVL =highly volatile liquid, EMT = Empty.	Y
COMMODITY2	Character	3	Same as COMMODITY1 except EMT is not valid.	N
COMMODITY3	Character	3	Same as COMMODITY1 except EMT is not valid.	N
CMDTY_DESC	Character	40	Comma separated list of the names of commodities carried by the pipeline system.	N
INTERSTATE	Character	1	(Y)es / (N)o designator to identify if the pipeline is an interstate pipeline. Y =Interstate, N =Intrastate.	Y
METADATA_ID	Character	8	Metadata database record associated with this pipeline system.	Y

Pipeline Segment Attribute Table (NPMS_SEG.AAT)

Field Name	Field Type	Field Length	Description (acceptable values in bold)	Required Field (Y/N)
FNODE#	Set by Arc	Set by Arc	ARC/INFO internal sequence number of the from-node.	Y
TNODE#	Set by Arc	Set by Arc	ARC/INFO internal sequence number of the to-node.	Y
LPOLY#	Set by Arc	Set by Arc	ARC/INFO internal number. NPMS will not have polygons. This number will always be set to zero.	Y
RPOLY#	Set by Arc	Set by Arc	ARC/INFO internal number. NPMS will not have polygons. This number will always be set to zero.	Y
LENGTH	Set by Arc	Set by Arc	ARC/INFO internal length in geographic coordinates.	Y
NPMS_SEG#	Set by Arc	Set by Arc	ARC/INFO internal record number.	Y
NPMS_SEG_ID	Set by Arc	Set by Arc	ID to be managed by ARC/INFO.	Y
NPMS_SYS_ID	Integer	8	ID for the pipeline system to which the polyline segment belongs.	Y
SUBSYS_NM	Character	40	Assigned by the operator. Name for a smaller sub-section of a pipeline system. A subset of SYS_NM.	N
PLINE_ID	Character	20	Assigned by the operator. An identifier for a specific pipeline segment or segments within a pipeline system.	Y
DIAMETER	Real	5	Nominal diameter of the pipeline segment, in inches with two decimal places.	N
STATUS_CD	Character	1	Current status of the pipeline segment. I =in service, B =abandoned, R =retired.	Y
QUALITY_CD	Character	1	Operator's estimate of the positional accuracy of the pipeline data: (E)xcellent = 0 to 50 feet, (V)ery Good = 51 to 300 feet, (G)ood = 301 to 500 feet, (P)oor = 501 to 1000 feet, (U)nknown.	Y
REVIS_CD	Character	1	Identifies this pipeline as A =addition to the NPMS, or M =modification to or D =deletion of a previous submission.	Y
ALBERS_MILES	Real	6	Real number with two decimal places. Mileage of the pipeline segment calculated using the Albers projection.	Y
SUBREPOS_CD	Character	2	Two-character code for the repository that processed the polyline segment.	Y

Exhibit 4. NPMS repository data model pipeline and LNG data.

The primary metadata table below has a one-to-many relationship to the primary source material table shown on the following page. The field “metadataID” is used to relate the tables.

Primary Metadata Table					
Field Name	Field Type	Field Length	Description (acceptable values in bold)	Required Field (Y/N)	Question Number
Submission Information					
ops_id	Integer	5	Operator ID (validated against OPS database).	Y	–
metadata_id	Character	7	Operator ID + hyphen + two-digit counter (maintained internally).	Y	–
submittalDate	Date	8	Date submittal was sent in to the repository.	Y	–
submitCD	Character	25	Reason for submittal: Addition, Spatial Modification, Attribute Modification Only, Metadata Modification Only, Change NPMS Contact Information, Change of Operator Report.	Y	1
spatialSubmitType	Character	10	Type of spatial submittal: Hard-Copy or Digital.	Y	2
descGeneral	Memo	100	General description of submittal.	Y	3
Geospatial Data Quality Information					
upToDate	Character	50	Most current date of pipeline and attribute data.	Y	4
modDate	Character	50	Date modifications were made to pipeline mapping or attributes.	Y	5
changeAware	Character	1	Have any changes been made to pipelines and/or facilities since the data was last modified? (Y/N)	Y	6a
descChanges	Memo	1	Description of changes made to mapping or attribute data that triggered a submission.	N	6b
listStates	Memo	100	List states in which the submitted pipelines reside.	Y	7
qualityCheck	Memo	100	List any quality checks performed on the pipeline and/or facility data.	Y	8
posAccuracy	Character	50	Positional accuracy of the pipeline and facility data: (E)xcellent = 0 to 50 feet, (V)ery Good = 51 to 300 feet, (G)ood = 301 to 500 feet, (P)oor = 501 to 1000 feet, (U)ncertain.	Y	9
determAccuracy	Memo	100	Briefly explain how the positional accuracy was determined.	N	10
Attribute Data Information					
attribQC	Memo	100	Description of any quality control performed on the attribute data.	Y	11
attribIncluded	Character	3	Were attributes included with submission? (Y/N)	Y	12
attribApp	Character	3	Was NPMS application used to create digital attributes? (Y/N)	N	13
attribFile1	Character	20	Attribute data filename.	Y	14
attribFile2	Character	20	Attribute data filename.	N	14
attribFile3	Character	20	Attribute data filename.	N	14
attribFile4	Character	20	Attribute data filename.	N	14
attribFile5	Character	20	Attribute data filename.	N	14
Projection Questions					
datum	Character	50	Datum: NAD27, NAD83, WGS 84, Other.	N	15
mesUnit	Character	50	Units of Measure: Feet, Meters, Miles, Kilometers.	Y	16
projection	Character	50	Projection: Albers, UTM, State Plane, None (LAT/LONG), Other (write in).	Y	17a
stateZone	Character	50	State name and zone number.	N	17b
UTMzone	Character	50	Selected from valid listing for respective projections.	N	17c
proiComments	Character	20	Hardware options include: Unix Workstation, NT Workstation, Windows PC, Macintosh, Other.	N	18
Digital Geospatial Data Transmittal Questions					
hardware	Character	20	Computer hardware used to create submission. Unix Workstation, NT Workstation, Windows PC, Macintosh, Other.	N	D19
oper_system	Character	20	Operating system options on which data was created include: Unix, Windows NT, Windows 95/98, Windows 3.1, DOS, MAC OS, Other.	Y	D20
software	Character	20	ARC/INFO, ArcView, Intergraph FRAMME, Intergraph MGE, Intergraph GeoMedia, MicroStation, MGE, Mapinfo, AutoCAD, Smallworld, Other.	Y	D21a
otherSoftwareName	Character	20	Description of other software used.	N	D21b
version	Character	50	Software version number.	Y	D22
digDataFormat	Character	50	E00, SHP, MIF, DWG, DXF, DGN, Generic/Generate.	Y	D23
digMedia	Character	15	Source Media: Online, Diskette, CD-ROM, ZipDisk.	Y	D24
digFile1	Character	20	Digital submission filename.	Y	D25
digFile2	Character	20	Digital submission filename.	N	D25
digFile3	Character	20	Digital submission filename.	N	D25
digFile4	Character	20	Digital submission filename.	N	D25
digFile5	Character	20	Digital submission filename.	N	D25
Hard-Copy Geospatial Data Transmittal Information					
hardSheets	Integer	3	Number of hard-copy sheets.	Y	H19
hardScale	Character	20	Scale of hard-copy submission: 1:1200 (1" = 100'), 1:2400 (1" = 200'), 1:4800 (1" = 400'), 1:6000 (1" = 500'), 1:12000 (1" = 1000'), 1: 24000 (1" = 2000').	Y	H20

Exhibit 5. NPMS repository data model metadata.

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Metadata Source Material Table					
Field Name	Field Type	Field Length	Description (acceptable values in bold)	Required Field (Y/N)	Metadata Question Number
sourceMatDescID	Number	2	Counter.	N	–
metadatalD	Character	7	Operator ID + hyphen + two-digit counter (maintained internally).	N	–
source	Character	50	Company that created the source material.	N	1
sourceDate	Character	50	Date in YYYY format (can be multiple years).	N	2
hardSubMat	Character	50	Hard-copy source medium: USGS Quad, Ground Survey, GPS Survey, Production Reports.	Y	3
hardPermMat	Character	50	Medium: Paper, Mylar, Vellum, Other (write in).	N	4
sourceDesc	Memo	100	Description of source used to create submission.	N	5
sourceDatum	Character	50	Source datum: NAD27, NAD83, WGS 84, Other.	N	6
sourceScale	Character	50	Scale of Source: 1:1200 (1" = 100'), 1:2400 (1" = 200'), 1:4800 (1" = 400'), 1:6000 (1" = 500'), 1:12000 (1" = 1000'), 1: 24000 (1" = 2000'), Other (write in).	N	7

Note: Operator contact information is moved to other tables prior to permanent storage.

Exhibit 5. NPMS repository data model metadata (continued).

4.3 The ALBERS_MILES Field

Distance Calculation (ALBERS_MILES). As a benefit to the end users of NPMS data, including operators and for repositories keeping statistics, it will be useful to include pipeline mileage as an attribute in the database. However, since the final coverage will be stored un-projected (geographic), the ALBERS_MILES field will be added to the Pipeline Segment Attribute Table during repository processing. Mileage will be calculated using the Albers projection. NPMS Standard Albers Projection Parameters include:

Projection	Albers Equal-Area Conic
Spheroid	Clarke 1866
Central Meridian	-96
Reference Latitude	37.5
Standard Parallel 1	29.5
Standard Parallel 2	45.5
Latitude of Projection's Origin	0
False Easting	0
False Northing	0

5. Data Dissemination

Data dissemination is one of the primary responsibilities of participating NPMS repositories. NPMS data clients will include pipeline operators, government agencies, and the general public. Repositories will work in conjunction with the OPS to determine the types of data that will be made available and the format type.

Repositories will immediately begin providing processed digital data back to the contributing operators upon request. One of the goals of the NPMS is to assist operators in progressing toward a fully digitized environment. Therefore, upon the digital conversion of hard-copy operator maps, the repositories will provide the processed data back to the operators. The format for the data will be determined between the sending repository and the receiving operator.

A policy for fulfilling non-government requests for NPMS data will be developed by the OPS in conjunction with the state and national repositories. The policy will define the products and services to be provided and, where appropriate, the fees to be charged.

5.1 Disclaimer

NPMS maps and data shall always be issued with a disclaimer. States may develop their own disclaimers. In all cases, the disclaimer should indemnify the United States Government, the U.S. Department Transportation Office of Pipeline Safety, contributing state governments, and contractors. A sample disclaimer follows:

"This map and/or digital data has been compiled by the United States Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety as part of the National Pipeline Mapping System (NPMS). The data is compiled from contributions made by pipeline and LNG facility operators and is processed by state agencies and private contractors. Neither the United States Government nor any party involved in the creation and compilation of NPMS data and maps guarantees the accuracy or completeness of the product. NPMS data should be considered no more accurate than ± 500 feet and must never be used as a substitute for contacting the appropriate local one-call center prior to digging."

5.2 Metadata Export Formats and FGDC Compliance

The National Repository will develop standard NPMS export formats. Routines for exporting NPMS data to commercial GIS and computer-aided drafting (CAD) programs will be built into the *Geospatial Data Conversion Tool*. Data users will be given three choices on how they wish to receive metadata.

1. **NPMS Standard Metadata.** For data users who do not require detailed metadata about each pipeline system, repositories will provide NPMS

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standard metadata. This will be an FGDC-compliant American Standard Code for Information Interchange (ASCII) text file representing NPMS data as a whole. Appendix C contains the current draft of NPMS standard metadata. NPMS standard metadata will be made available on the NPMS Web Site.

2. **NPMS Detailed Metadata Database Format.** For data users who require more comprehensive metadata, repositories will provide metadata in Microsoft Access format. This will include detailed metadata collected from pipeline operators. This format will be most useful for large institutional users of NPMS data, such as the U.S. Environmental Protection Agency. Metadata will be provided in this format by special request only.
3. **NPMS Detail Metadata FGDC Format.** The National Repository will create a module of the *Geospatial Data Conversion Tool* (a database report) which will create an FGDC-compliant ASCII metadata file for the pipeline systems and LNG facilities being exported.

6. NPMS Data Storage Procedures

Each repository will develop safeguards to ensure against loss of digital data. Daily backups of the repository data sets will be required, and the backup media will be stored off-site or in a vault protected from natural and manmade disasters. Each repository is required to meet the following minimum standards for disaster recovery:

- ◆ Incremental backups on digital media such as tape, compact disks (CD), or large-capacity diskettes will be made once every 24 hours. These backups will be kept for a minimum of 10 working days.
- ◆ A full backup of the entire repository database will be made once per week. These backups will be kept for a minimum of three months.
- ◆ An additional full backup of the repository database will be made once per month. This backup will be kept for a minimum of one year.
- ◆ A system emergency recovery tape or diskette (boot tape or disk) will be made for each workstation prior to its use in processing data for the NPMS.
- ◆ Each repository will have written documents detailing local procedures for backups and disaster recovery.
- ◆ All backup media will be stored in a safe, secure area.
- ◆ NPMS-related documents or data will be isolated from other projects common to a state repository and the National Repository.

6.1 National Repository File-Naming and Storage Conventions

The National Repository will process submissions in eight steps, as graphically shown in Exhibit 1 and Exhibit 6. At each step, data storage and file-naming conventions will be employed. File names and directories will be generally the same as the SUBMISSION_ID. Files will not be deleted as a submission progresses from one step to another. This will preserve the ability to start over by returning to the previous step.

The National Repository will keep an inventory of all files, correspondence, and physical items received from operators in its master database. Physical items such as hard-copy correspondence, hard-copy maps, and submitted diskettes will be disposed of after one year.

These standards are written assuming the storage and naming scheme below; however, state repositories may adopt their own conventions. Another valid scheme is to maintain one directory for each SUBMISSION_ID and to adopt an alternative naming convention for the files within that directory. When transmitting files to the National Repository, states should use the SUBMISSION_ID as the file name, as discussed in Section 2.3.3.

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Step	Directory	File Name
Step 1	Operator sends files.	Uses file-naming conventions from the <i>Operator Standards</i> .
Step 2	\\NPMS\CHECK-IN\SUBMISSION_ID*.*	Same as submitted by operator.
Step 3	\\NPMS\REVIEW\SUBMISSION_ID*.*	SUBMISSION_ID".MDB. (Metadata file) Other files should be the same name as submitted by operators.
Step 4a	\\NPMS\CAPTURE\SUBMISSION_ID*.*	SUBMISSION_ID".DGN (CAD file) SUBMISSION_ID".MDB (Metadata file)
Step 4b	\\NPMS\PROCESS\SUBMISSION_ID*.*	SUBMISSION_ID".E00 (Arc coverage) SUBMISSION_ID".MDB (Metadata file)
Step 5	\\NPMS\INTERSTATE\SUBMISSION_ID*.*	SUBMISSION_ID".E00 (Arc coverage) SUBMISSION_ID".MDB (Metadata file)
Step 6	Applies to state repositories only.	—
Step 7	\\NPMS\QC\SUBMISSION_ID*.*	SUBMISSION_ID".E00 (Arc coverage) SUBMISSION_ID".MDB (Metadata file)
Step 8	Submission is incorporated into the master NPMS Arc/Oracle database. Files submitted by the operator are archived to tape. All intermediate processing files are deleted.	

Exhibit 6. National Repository digital file storage and file-naming conventions.

7. Inter-Repository Coordination

To promote an efficient working relationship between repositories, and to help keep state and national databases synchronized, the OPS will host an annual meeting for repository managers. In addition, each repository manager will be responsible for filing a monthly status report on the NPMS Web Site. Particulars include

- ◆ **Annual Meeting.** The OPS will host an annual meeting for repository managers to discuss policy decisions and technical procedures to be established for the upcoming year. Each repository will be required to send a representative.
- ◆ **Mailing Lists.** Whenever the OPS or a repository sends an NPMS-related mass mailing or e-mail to operators, all repositories and the OPS should be copied. This will help all parties keep track of what others are doing. It should also promote consistency in the information being sent to interstate pipeline operators.
- ◆ **Quarterly Reporting.** Each repository manager will file a monthly report using an interface on the NPMS Web Site. The National Repository will compile statistics from the reports and post them to the NPMS Web Site. The statistics (e.g., total mileage by state) will help to reveal if state repositories and the National Repository are keeping the same data or if significant discrepancies exist. The National Repository's report will divide statistics between Baker-Beaver and HDM. Monthly reports shall include
 - repository name,
 - manager name,
 - number of submissions received,
 - number of submissions rejected,
 - number of submissions received by SUBMISSION_TYPE,
 - number of different operators making submissions,
 - number of submissions processed to compilation,
 - mileage added to the NPMS,
 - total number of submissions processed during the calendar year,
 - total NPMS miles processed during the calendar year,
 - total NPMS miles in the repository's database,
 - number of submissions containing hard-copy geospatial data,
 - total NPMS miles of submissions containing hard-copy geospatial data,
 - number of submissions containing digital geospatial data,
 - total NPMS miles of submissions containing digital geospatial data,
 - number of data dissemination requests received,

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- number of data dissemination requests processed,
- significant problems or incidents encountered (will be connected via the Web, but will not be posted to the NPMS Web Site), and
- ideas for improvement (will be connected via the Web, but will not be posted to the NPMS Web Site).

7.1 Repository-Initiated Corrections to NPMS Data

Other than pipeline and LNG facility operators, only NPMS repositories and the OPS may initiate changes to the NPMS database. For example, a Texas Railroad Commission Inspector could discover a problem with an NPMS map and request the Texas Repository to make a change. At the state repository manager's discretion the change may be made. It will also be at the discretion of the repository manager whether to consult the operator of the affected pipeline system prior to making the change or whether to simply notify that pipeline operator that a correction has been made.

Such changes will be processed in the same manner as submissions coming from operators, with the following exceptions:

1. The SUBMISSION_ID will contain a repository code where the OPS_ID would normally be stored. For example:

SUBMISSION_ID = TX-000TX-0001

2. Metadata will be updated to describe significant changes.

The operator of the affected pipeline system shall be notified of significant changes to the NPMS database.

8. Detailed Submission Processing Procedures

This section describes the way in which submissions will pass from pipeline and LNG facility operators, through state or National Repository processing, to quality control and final incorporation into the NPMS database. Refer to Exhibit 1 for a graphical representation of this process. Detailed procedures follow.

Step 1. Operator Submission

A submission is sent on-line or via mail by a pipeline operator or the operator's agent to an NPMS repository. Rules set forth in Section 1.4 of the *Operator Standards* determine which repository should receive the submission.

Step 2. Repository Check-In

Check-in is the first step taken by a repository when a new submission arrives. Every submission shall be checked in within one business day after its arrival.

Whether a submission arrives at a state repository or the National Repository, logging will be accomplished by connecting to the repository section of the NPMS Web Site and completing a brief form. After the SUBMISSION_ID has been assigned, the state repositories are free to develop their own check-in procedures. The National Repository's check-in procedures are provided below as a guide.

National Repository Detailed Check-In Procedures

If a submission is sent to the National Repository via the operator section of the NPMS Web Site, the check-in process will be completely automated. If the submission arrives via mail, a manual check-in procedure will take place.

Manual check-in is a five-step process. The submission is 1. Logged, 2. Scanned for viruses, 3. Inventoried, 4. the Operator is notified, and 5. Procedures are tracked. The National Repository will have an area (an office cubicle) dedicated to the NPMS project where the check-in process will take place. The cubicle will have a personal computer, a Costar label printer, a conventional filing cabinet, and several bins used for routing source materials. A detailed discussion of the five-step process follows:

1. **Log Submission.** Logging a submission is the process of assigning the correct SUBMISSION_ID and registering the submission with the National Repository master database. The SUBMISSION_ID is a unique identifier assigned to each submission. Every submission that arrives at a repository must be assigned a SUBMISSION_ID, even if the submission is obviously incomplete or otherwise non-standard.
2. **Scan Digital Submissions for Viruses.** Every incoming diskette, CD-ROM, zip disk, or digital file transmitted on-line will be scanned for

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computer viruses using a commercial off-the-shelf software package. If a virus is detected, the repository (at its discretion) may choose to inoculate the virus and proceed, or request a new version of the submission from the operator.

3. **Inventory All Submission Items.** Every item that passes the virus check will be inventoried. State repositories may develop their own inventory and submission item tracking procedures. The National Repository will conduct a submission item inventory and initiate submission item tracking in the following manner:

The *Submission Management Tool* will assist with the inventory process by writing to the *NPMS Master Database*. First, the technician performing check-in will fill out a brief series of questions about each physical item. Physical items include hard-copy correspondence, diskettes, digital files, and hard-copy map sets. Second, a label will be printed for and affixed to each physical item, including each map sheet in a map set. A Costar label printer and self-adhesive mailing labels will be used. Third, all digital files associated with the submission will be copied to the primary NPMS server. The files will be stored on the NPMS server according to the convention: `\NPMS\CHECK-IN\“SUBMISSION_ID”*. *.` Fourth, physical items such as disks, CDs-ROM, and zip disks will be placed in a storage bin. A photocopy will be made of any hard-copy correspondence. The original correspondence will be filed in a standard filing cabinet according to the calendar month in which the submission was received. The copy of the correspondence and all other physical items will be placed in a bin labeled “check-in complete.”

4. **Notify the Operator of Submission Receipt.** The repository will notify the operator that the repository has received the submission. The notification will be via e-mail, if possible. The notification will include the SUBMISSION_ID, which serves as the operator’s tracking number. The notification will also provide the operator with instructions on how to track work on the submission using the NPMS Web Site.
5. **Track Procedures.** The technician will connect to the NPMS Web Site and update the submission tracking information. Problems encountered and actions taken will be reported at this time.

Step 3. Metadata Review and Repair

The metadata file(s) is extremely important because it serves as a transmission form as well as the metadata. Various NPMS applications, particularly the *Geospatial Data Conversion Tool*, will depend on information obtained from the metadata to complete processing in an automated manner. If necessary, repairs will be done to make the metadata acceptable. Finally, the submission will be routed for appropriate processing.

The *Submission Management Tool* will provide assistance throughout the process. With the assistance of the tool, the technician will:

1. **Read any correspondence** that arrived with the submission.
2. **Locate the submission metadata file(s).** The operator should create metadata using the *NPMS Metadata Template* software, which creates a Microsoft Access .MDB file. The operator should also name that file “M-OPS_ID-01.MDB.” The database created by the *NPMS Metadata Template* is shown in Appendix C. The questions that operators are asked to complete are shown in the *Operator Standards*.
3. **Create a directory** on the server called
\\NPMS\REVIEW\“SUBMISSION_ID.” Copy the metadata file from the
\\NPMS\CHECK-IN\“SUBMISSION_ID”*.MDB directory to the new
directory. Rename the file according to the SUBMISSION_ID. The file
name should be “SUBMISSION_ID”.MDB. If the file does not exist or
is in the incorrect format, create a blank metadata file.
4. **Review the metadata file** with the *Submission Management Tool*. This
Microsoft Access application will facilitate working with NPMS
metadata. The technician must also make common sense spot checks
against the submitted geospatial and attribute data. The application will
create a report containing the most important points from the metadata.
The report will alert the technician if key fields are missing, or if key
fields are outside the acceptable ranges.

If metadata is incorrect, was not submitted, was not submitted in the proper format, or the *Submission Management Tool* identifies key aspects as missing or deficient, the technician shall complete all required sections of the metadata. The technician will complete the metadata by the methods below:

- a. Attempt to complete the metadata by examining the submission.
- b. If necessary, contact the operator to complete the submission.
- c. Conduct additional research if the operator and technician cannot resolve the issue.
- d. Propose a technical solution, which is optional at the repository’s discretion.

For example, (a–examination) if the operator did not include the datum on a hard copy map, the technician would refer to the map’s legend. (b–contact) If the datum was not included in the map’s legend, then the technician would call the operator and attempt to resolve the missing datum issue. If that fails, (c–additional research) then the technician could attempt to acquire the datum by calling the survey firm that originally created the map. Finally, (d–technical solution) the technician may propose registering the map to a USGS quad sheet using landmarks common to both maps.

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5. **Verify that all files and/or map sets for the submission have been received.** A file count and name check will be performed. The data sets received will be verified against the transmission information in the metadata. If there are any discrepancies, the submission will not proceed until the file count and name checks are correct. The operator should be contacted for clarification.
6. **Capture attribute data.** If the operator did not submit digital attribute data, but rather included attribute data as annotation on hard-copy maps, the attribute data will be captured at this time using the *NPMS Attribute Data Template* software (see *Operator Standards*). If problems with the attribute data are encountered, the pipeline operator should be contacted for clarification.
7. **Use the NPMS Web Site to record that the metadata review and repair set is complete.** The technician should record any comments. The comments may be critical for the technicians processing the data.
8. **Route the submission for processing.** The National Repository will route hard-copy maps to Baker's Beaver, Pennsylvania, office and process digital geospatial data at the Alexandria, Virginia, office.

Step 4a. Hard-Copy Data Conversion

Hard-copy data conversion will have two primary steps: validation/preparation and capture. (The National Repository will perform the validation in Alexandria, Virginia; all remaining work will be performed in Beaver, Pennsylvania. Validation in Alexandria will be minimal and designed only to avoid incurring shipping costs for map sets that obviously do not meet minimum standards for digitizing.)

Step 4a.1. Hard-Copy Map Set Validation/Preparation

When the source data is received by Baker personnel, it will be entered into the source document log using the NPMS Web Site. The SUBMISSION_ID map name/number and date, receipt date, and any additional remarks will be recorded. Source data will then be reviewed to ensure that all attribute data has been received in accordance with database requirements.

Listed below are key topics and questions the repository should address when validating submitted hard-copy data.

- ◆ **Scale.** Is the map a 1:24,000 USGS quadrangle map? For those areas where 1:24,000 USGS topographic maps are unavailable, is the map of the largest scale available by the USGS for the area? If the map is not a USGS map, does its scale still meet NPMS standards? If not, then the map is unacceptable.
- ◆ **Projection.** If the base map is not a USGS map, has the base map been produced using geospatial coordinates? If not, then the map is

unacceptable. If the map is acceptable, the operator must provide the projection, datum, and map units on the map. If any of the information is incomplete or missing, the repository will contact the operator.

- ◆ **Control.** Does the map have at least four georeferenced control points that may serve as map registration marks for digitizing? If not, and the repository is unable to create the needed registration marks using USGS quad sheets, then the map is unacceptable.
- ◆ **Color and Symbolology.** Has the operator provided a legend defining the colors and symbols used on the map? If not, the repository will contact the operator for clarification.
- ◆ **Facility Location and Labeling.** Are the operator's facilities (pipelines and LNG facilities) clearly distinguishable on the map? If not, the repository will contact the operator for clarification. Are they clearly and uniquely labeled? If not, the repository will contact the operator for clarification.
- ◆ **Pipeline Type.** The NPMS is only to contain transmission pipelines. National Repository staff shall be trained to recognize the typical appearance of distribution lines and gathering lines as opposed to transmission lines. If the repository suspects that a map contains non-transmission lines, the operator will be contacted. Confirmed non-transmission lines will be marked to prevent inadvertent digitizing. States that collect non-transmission lines should delete them from the submission prior to forwarding the data to the National Repository for processing.
- ◆ **Linkage.** Is there a unique numeric element for each pipeline or LNG facility on the map that references a specific attribute record? If not, and the repository is unable to determine which map features correspond to the appropriate attribute data records, the repository will contact the operator for clarification.
- ◆ **Edge-Matching.** Were the maps edge-matched prior to submission? If not, the repository should perform edge-matching on a random sample of 10 percent of the maps to determine how well features match across sheets. If it is determined that the majority of maps do not edge-match within the ± 500 -foot positional accuracy standard, the maps are unacceptable.
- ◆ **Marking.** Operators are requested to prepare their maps for digitizing by highlighting/coloring pipelines and marking map page numbers. Control points will be highlighted on each source map to ensure proper map alignment. If the operator did not prepare the map set, repository staff will complete this task.
- ◆ **Tracking Procedures.** When the map set has been validated and prepared, the technician will connect to the NPMS Web Site and update the tracking information. Problems encountered and actions taken will be reported at this time.

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Step 4a.2. Hard-Copy Data Capture

The National Repository will adhere to the following production procedures.
State production techniques may differ.

After all data has been validated, complexity of the source maps will be determined. Source maps of low density will be board-digitized. For example, the more complex maps that may contain many pipelines in close proximity may be heads-up digitized. A control sheet for source maps/data received will be completed to track required processes and procedures. The control sheet, generic in nature and developed in accordance with all the required processes and procedures, will be modified with additional tasks depending on the condition and format in which source maps and data are received.

1. **Create .DGN File.** A MicroStation design file (.DGN) will be created for each source map received. The design file will be created in a format compatible with the format of the control data of the source data received.
The file will be stored in a directory called
\\NPMS\CAPTURE\“SUBMISSION__ID.”
The file name will be “SUBMISSION_ID”.DGN.
2. **Register Map.** When screen or board digitizing, each map sheet must be registered using at least four control points. Check the root mean squared error (RMS error) of the registration. The NPMS will accept an RMS error of 0.01 inches or less. If required, the technician will reposition the raster data until the acceptable RMS value is attained.
3. **Data Capture.** The pipeline and LNG data is then captured in accordance with the project specifications. Each PLINE_ID or OPER_LINK is also captured and associated with the appropriate line segment.
4. **Edge-Match.** As the capture process proceeds, each subsequent map is edge-matched to adjacent data.
5. **Quality Control.** After all the vector and attribute data are captured, the file is plotted and a visual quality control is made on all the data to ensure that all the data is captured correctly and the file is complete.
6. **Track Procedures.** The technician will connect to the NPMS Web Site and update the submission tracking information. Problems encountered and actions taken will be reported at this time.
7. **File Routing.** The .DGN file is then routed to Step 4b, Digital Data Conversion. If the submission was heads-up digitized, the scan will be archived to tape.

Step 4b. Digital Data Conversion

During digital file conversion, geospatial data that has been produced by digitizing hard-copy maps and geospatial data submitted by operators in digital format is converted to an ARC/INFO coverage and combined with the appropriate attributes. Throughout this process, the technician will be assisted by the *Geospatial Data Conversion Tool*. Step-by-step instructions are provided below.

1. **Copy Files.** All submission files should be copied from the
\\NPMS\\REVIEW\\“SUBMISSION_ID” and
\\NPMS\\CAPTURE\\“SUBMISSION_ID” directories to a new directory
called \\NPMS\\PROCESS\\“SUBMISSION_ID.”

Always use the *Geospatial Data Conversion Tool* when performing Steps 2–8, below. The *Tool* will be designed to set proper tolerances and to preserve the distinction between “pipeline crossings” and “pipeline intersections.”

When using ARC/INFO’s “BUILD” command, always use the “LINE” option.

Never use ARC/INFO’s “CLEAN” command on NPMS data!

2. **Translate Geospatial Data.** Translate the geospatial data to ARC/INFO with assistance from the *Geospatial Data Conversion Tool*. The *Tool* will automate many of the following procedures, which vary, based on the geospatial data format provided by the pipeline operator. The ARC/INFO coverage created should be named with the “SUBMISSION_ID.” (See Appendix A for sample translation steps.)
3. **Translate Attribute Data.** If not already translated, convert the attribute data to the INFO format. The translation can be accomplished with a wide variety of techniques, depending on the attribute data format provided by the pipeline operator. The *Geospatial Data Conversion Tool* will automate converting from Microsoft Access (.MDB), DBASE (.DBF), and delimited ASCII files (.TXT).
4. **Re-Project.** Re-project the coverage to the Albers projection. (State repositories may use the local projection of their choice.) **This critical step must be performed prior to “line check”** because ARC/INFO tolerance settings are meaningless when the coverage is in geographic coordinates.
5. **Line Check.** Line check is a series of modules within the *Geospatial Data Conversion Tool* that creates “clean” linework that adheres to project specifications. The software corrects linear errors in the translated linework, such as over shoots and undershoots, within a tolerance of 100 feet on the ground. Remaining errors are flagged for revision by a technician. Corrections are made in ARC/INFO. After the linework errors are corrected, the *Geospatial Data Conversion Tool* is

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reinitiated, and the coverage is rechecked. Further processing is terminated until the coverage is “clean.”

6. **Connectivity.** Connectivity is validated to ensure a uniform and continuous pipeline network. Each pipeline system is checked to ensure connectivity exists between all beginning and ending points. The pipelines and facility features are tagged when connectivity is validated. Remaining features are flagged for operator revision. The *Geospatial Data Conversion Tool* is reinitiated after the errors are corrected. Further processing is terminated until connectivity is completed.
7. **Attribution.** Attribution is assigned by relating the ARC/INFO .PAT and .AAT files with the converted INFO table created above. These files are linked with the unique identifier, OPER_LINK. The feature attribute records are populated by extracting information from the INFO table.
8. **Attribute Data Check and Repair.** The *Geospatial Data Conversion Tool* will have procedures for checking the translated attribute data against the *Operator Standards*. All required fields, as defined in the project specifications, are verified for record attribution. Domain values are checked for both required and optional fields in accordance with the project data dictionary. (These procedures are described in more detail in Step 6, Quality Assurance and Quality Control.) Records failing either the required attribution or the domain check are flagged for the technician to correct. Attribute information is extracted from the given sources and the corrections are made in the submission's INFO table. The technician will notify the appropriate supervisor when corrections cannot be resolved with the given sources. If problems with the attribute data are encountered, the pipeline operator should be contacted for clarification. Further processing is terminated until all records contain data within the required fields and domain values are validated.
9. **Tracking Procedures.** The technician will connect to the NPMS Web Site and update the submission tracking information. Problems encountered and actions taken will be reported at this time.

Step 5. Interstate Processing

After the pipeline data and LNG facility data is “clean” and in ARC/INFO format, several important processing steps are required.

1. **Copy Coverage.** Use the ARC/INFO COPY command to copy the coverage from the \NPMS\PROCESS\“SUBMISSION_ID” workspace to the \NPMS\INTERSTATE workspace. The coverage name should still be its SUBMISSION_ID.
2. **Re-Project Coverage.** If the coverage is not already in the Albers projection, it should be re-projected at this time. Albers projection parameters are in Section 4, NPMS Repository Data Model.

3. **Add New Fields.** Using the *Geospatial Data Conversion Tool* and the ARC/INFO ADDITEM command, add the following items to the arc attribute table, SUBMISSION_ID.AAT:
 - NPMS_SYS_ID (Integer, 6 digits)
 - ALBERS_MILES (Real Number, 4 digits + 2 decimal places)
 - SUBREPOS_CD (Character, 2 alpha)

4. **Research and Assign NPMS_SYS_ID.** Every transmission pipeline system and LNG facility processed by a state repository or the National Repository will be assigned an NPMS_SYS_ID. The goal is to have pipeline systems maintain a consistent NPMS_SYS_ID even as they pass through and are processed by various states. NPMS_SYS_IDs will be assigned sequentially by the National Repository. State repositories will obtain new NPMS_SYS_IDs by connecting to the NPMS Web Site. The NPMS Web Site will assist repository staff identify whether a portion of the pipeline system is already in the NPMS database.

For example, assume that New Jersey is the first state to process a given pipeline system. The technician will connect to the NPMS Web Site and search for the system using OPS_ID and SYS_NM. Finding no comparable system, the technician will then complete a brief form on the NPMS Web Site. The NPMS Web Site will return a new NPMS_SYS_ID – 123456, for example.

When Pennsylvania processes the same pipeline system, its technician will find NPMS_SYS_ID = 123456 on the NPMS Web Site. Pennsylvania will use that NPMS_SYS_ID.

5. **Break Arcs.** To make the NPMS more useful for a wide variety of statistical analyses and cartographic purposes, it is necessary to break arcs (pipeline segments) three miles from the state boundary. The *Geospatial Data Conversion Tool* will assist with that procedure. The National Repository will provide a master continental United States coverage to be used to break arcs. The coverage will extend state boundaries offshore for an appropriate distance (to be determined by the OPS). Separate coverages in different projections will be created for Alaska and Hawaii. (See Exhibit 7, Handling of State Boundaries).
6. **Interstate Edge-Matching.** It is essential that NPMS data maintain continuity and connectivity when crossing state boundaries. Since both the National Repository and state repositories will be working concurrently, there will be a careful procedure followed to ensure that pipeline systems are properly edge-matched at state boundaries. These procedures are discussed below.
 - a. Repositories will be responsible for adjusting their own data and will not be allowed to adjust data that originated at another repository.

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- b. Pipelines will always be adjusted by moving the pipeline that is considered to be less accurate to match the pipeline that is believed to be more accurate.
- c. If the pipelines are considered to be equally accurate, then the pipeline system that is new to the NPMS will be adjusted to match existing data.
- d. Adjustments will be averaged over a distance of 1,000 feet from the state line. The repository making the adjustment will place a node 1,000 feet from the state line, creating a new pipeline segment.
- e. If the distance between the arcs is greater than 1,000 feet, the National Repository manager will be notified and a resolution pursued.

1	The National Repository will provide the official state boundary coverage for the NPMS project.
2	State repositories will be given an opportunity to comment on the official state boundary coverage, and the appropriate adjustments will be made. However, it may not be possible to resolve all problems.
3	Once the official state boundary coverage has been adopted, all repositories will use it to place a node where each pipeline system crosses the state boundary.
4	Because the official state boundary coverage will be imperfect, it will not be used for cropping data.
5	To ensure that states have sufficient data to work with, the National Repository will buffer the state boundary by three miles before clipping pipeline data and providing it to the states. This will include three miles in offshore areas. Three miles has been chosen because it is the typical boundary of state waters and should be more than sufficient for dealing with inland border questions.
6	Texas will be an exception due to its unusual maritime jurisdiction, and will be buffered by 10 leagues instead of three miles.

Exhibit 7. Handling of state boundaries.

- 7. **Populate SUBREPOS_CD.** Populate SUBREPOS_CD with the two-character code of the processing repository.
- 8. **Calculate Pipeline Distance.** As a benefit to the final users of NPMS data, including operators and repositories, it would be useful to include pipeline mileage as an attribute in the database. However, since the final coverage will be stored un-projected (geographic), it is necessary to calculate mileage while the coverage is still in the Albers projection. Follow the steps below:
 - a. Build line topology.

- b. The LENGTH item in the SUBMISSION_ID.AAT file will be meters; so a calculation will be made to convert to miles. In INFO, $\text{CALCULATE ALBERS_MILES} = \text{LENGTH} * 0.00062$. The ALBERS_MILES field should always be calculated using the official National Repository Albers projection. (See Section 4.3).
9. **Remove non-NPMS Standard Data.** If a state has included additional features, such as distribution pipelines, or additional attribute data, such as pressure ratings, then non-NPMS standard data should be removed at this time.
10. **Save Coverage.** Save the coverage by its SUBMISSION_ID name in the workspace called \NPMS\QC\.
11. **Data Transmission.** The state will then transmit the data to the HDM quality control team (QC Team) using an interface of the NPMS Web Site.
12. **Track Procedures.** The technician will connect to the NPMS Web Site and update the submission tracking information. Problems encountered and actions taken will be reported at this time.

Step 6. Quality Assurance and Quality Control

HDM will operate an independent QC Team. The team will be responsible for performing quality control checks on all NPMS data, including data originally submitted to state repositories.

The QC Team will not correct any errors that are found in the data set. All errors, regardless of their simplicity or frequency, will need to be corrected by the submitting repository. Following an error report, a new submission of the data set must be sent to the QC Team until all quality assurance/quality control (QA/QC) tests are passed. The procedures that will be followed by the QC Team are discussed below.

Step 6.1 QC Team Data Check-In

After a submission has been completely processed, but prior to appending the submission to the master NPMS data set, repositories shall send all submissions to the QC Team. Transmissions will be sent via an interface on the NPMS Web Site.

Upon receipt of a submission, the QC Team will:

1. **Log receipt** of each submission using an interface on the NPMS Web Site.
2. **Copy the submission** to their system. (All QA/QC screening and testing will be performed on the copy.)

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3. **Scan for viruses.** The submitting repository will be notified via e-mail if any viruses are detected.
4. **Verify that all files for the submission have been received.** A file count and name check will be performed. The data sets received will be verified against the submitting repository's transmission information. If there are any discrepancies, the submission will not proceed until the file count and name check are correct. If any submission data is missing information, a list of those files will be e-mailed to the submitting repository.
5. **Determine if the data set is new.** Any pipeline information submitted to the National Repository or the QC Team for the first time will be considered a new data set and the QC_VER_NO will be set to 01. This includes any pipeline data that has not undergone the QA/QC process as well as any data that adds new information to a previous data set. Any re-submission of a data set that includes only corrections will be considered a new version, and the QC_VER_NO will be updated.
6. **Store the received data.** The QC Team will store data received from the National Repository using the standard on-line storage scheme. All data will be stored in an NPMS directory in the QC Team's system. Separate folders will be created for each SUBMISSION_ID. Any e-mail correspondence between the QC Team and the submitting repository, and other relevant information will also be stored in this directory.
7. **Post the data set to the NPMS Web Site.** The QC Team will perform automated and visual screenings of the submission, and will report any problems encountered and actions taken.

Step 6.2 Automated Screening Program

The QC Team will coordinate with the National Repository and ESRI to develop an automated screening program that will provide an initial QC check of NPMS files. The application will perform a set of automated data quality tests on 100 percent of each submission. If errors are encountered during this screening, an error report will be automatically generated and written to a file. This information will be forwarded to the submitting repository. The following sections include a detailed description of the automated screening program.

When a completed submission has been loaded onto the file server, the QC Team will run the data through the automated screening program. A QC technician will start the program, set the path to the data, and click the "Start" button. The program will cycle through each file it encounters (at the specified path) and will test for errors in each of those files. The following data checks will occur:

1. **Check Field Attribute Value.** The automated screening program will check if every field has an acceptable value present within the submitted

data if it is required. The following is a list of the required fields for the NPMS:

NPMS_SYS_ID	STATUS_CD
OPS_ID	QUALITY_CD
OPER_NM	REVIS_CS
SYS_NM	ALBERS_MILS
PLINE_ID	SUBREPOS_CD
COMMODITY1	METADATA_ID
INTERSTATE	

2. **Check Attribute Data Rules.** The automated screening program will check for adherence to the following NPMS rules:
 - a. Use only UPPERCASE when defining field names.
 - b. Omit all punctuation except periods (.), spaces (), backslashes (\), colons (:), commas (,), hyphens (-), and underscores (_).
 - c. Use only NPMS-specified abbreviations.
 - d. Maintain consistency. Names and terms should be exactly replicated throughout a submission. For example, if a pipeline system is named Pennsylvania Line (SYS_NM = "Pennsylvania Line"), the operator should not use alternative names like "PENN Line," or "PA Line," or "Pennsylvania."
 - e. Use the correct and valid OPS_ID.
3. **Check Attribute Value Against the Allowable Range.** The automated screening program will check every field to ensure that the value in that field is within the allowable range. The following is a list of the acceptable values:

NPMS_SYS_ID = Positive Integer	COMMODITY3 = Character: blank, HG, CRD, LPG, NG, PRD, AA, CO2, NGL, or HVL
NPMS_SEG_ID = Positive Integer	CMDTY_DESC = Character
OPS_ID = Positive Integer	INTERSTATE = Character: Y or N
OPER_NM = Character	STATUS_CD = Character: I, B, R
SYS_NM = Character	QUALITY_CD = Character: E, V, G, P, or U
SUBSYS_NM = Character	REVIS_CD = Character: A, M, or D
PLINE_ID = Character	ALBERS_MILES = Real Number: ####.##
DIAMETER = Positive Integer	SUBREPOS_CD = Character: A Valid Repository Code
COMMODITY1 = Character: HG, CRD, LPG, NG, PRD, AA, CO2, NGL, or HVL	METADATA_ID = Character: TBD
COMMODITY2 = Character: blank, HG, CRD, LPG, NG, PRD, AA, CO2, NGL, or HVL	

4. **Check Field Attributes That Cross Reference Data Tables.** The QC Team will perform an automated check on any field that can be cross referenced to other National Repository/OPS databases. These checks

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will compare the OPS_ID field to a table of operator IDs and names provided by the OPS. All OPS_ID values must match a record in this table.

- a. The OPER_NM field will be checked against the matched record and a consistent OPER_NM value will be required for each OPS_ID.
 - b. The type of modification indicated in the REVIS_CD will be verified against the current data in the repository.
 - c. The SUBREPOS_CD will be checked against the list of active repositories.
5. **Check Fields That Can Be Cross Referenced to Metadata.** The following information will be verified:
- a. Operator name.
 - b. Type of modifications submitted, as indicated in the metadata versus the REVIS_CD in the attribute file.
 - c. Positional accuracy in the metadata versus the QUALITY_CD.
 - d. Type of submittal (digital or hard-copy) versus the submittal type in the project database.
 - e. Proper sections of the metadata have been completed based on submittal type.
 - f. Dates in the metadata are valid dates within an appropriate range.
6. **Check Topological Structure/Connectivity of Data Set.**
- a. Check if pipeline systems are connected.
 - b. Check for duplicate line segments.
7. **Develop Statistical Abstract of the Submission.**
- a. List all NPMS_SYS_IDs and system names.
 - b. List all states, counties, and offshore traverses.
 - c. List total length.
 - d. List commodities.
 - e. Flag changes in attributes.
8. **Track Procedures.** An automated screening report will be sent to the National Repository via the NPMS Web Site at the completion of the automated screening. If no errors are detected during the automated screening, the QA/QC technician will send an automated screening report to the National Repository indicating that the data set has passed the automated screening process and is now ready to begin the visual screening process.

If errors are detected during the automated screening process, the QA/QC technician will compile a more detailed automated screening report. The

report will include all errors detected during the automated screening process and the number of times each error occurred within the data.

Step 6.3 Visual Screening Process

The QC Team will conduct a two-level visual review of each system in each submission only after the entire submission has passed the automatic screening process. The first level of the review will involve looking at each system of every submission in a limited (small-scale) view. This review will concentrate on “the big picture” and will involve viewing the entire system as a whole, to ensure there are no noticeable errors. Thematic maps that show each individual system will be created and checked for accuracy and completeness. The following procedures will be followed:

1. **Zoom to Full Extent, Verify Overall Integrity.** This check will typically identify large, systematic problems. The QC technician will evaluate the data to ensure that it is connected together properly, generally appears in the correct location, and has the overall expected shape.
2. **Thematically Shaded Attributes.** To visually inspect the pipeline’s attributes, the QC technician will modify the colors and patterns used to display the pipeline based upon the attribute value associated with each segment. This process is known as thematic shading. Many of the attributes should be consistent at the full extent of a pipeline system. By thematically shading the attributes, the QC technician can identify if any section of the pipeline has been miscoded or is inconsistent with the rest of the data. With the full extent displayed, the QC technician will thematically shade each of the following attributes: SUBSYS_NM, DIAMETER, COMMODITY1, COMMODITY2, COMMODITY3, CMDTY_DESC, STATUS_CD, QUALITY_CD, and REVIS_CD. The QC technician will also label the pipeline segments with the PLINE_ID.

Step 6.4 Detailed Visual Screening

The QC Team will randomly select five percent of submissions to undergo the rigorous visual QA/QC test. The QC Team will contact the appropriate repository and request all original submission materials. The process submission will be checked against the original source. The percentage of submissions selected will be evaluated from time to time based on error rate trends. The selection will also take into account the repository submitting data to ensure that some data from all repositories are inspected in detail. This review will include a more subjective look at the complex areas of individual submissions, such as intersecting points, state boundaries, and rights-of-way.

1. **Interstate Pipeline Systems.** Pipeline systems that cross a state boundary present a unique challenge for the QC Team. Because most of the repositories are only responsible for submitting data for their

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individual state jurisdiction, the boundaries signify the beginning or end of the information for which the repositories are responsible. Where pipelines cross from one state to another, discrepancies are likely to occur. Therefore, the QC Team will inspect all pipelines that cross a state boundary to ensure that there are no discrepancies between the information provided by the submitting repositories. If there are discrepancies, a report detailing the anomalies will be sent to each repository. Since the QC Team does not correct data, the individual repositories will be responsible for correcting any inconsistencies. It will be recommended that the information deemed to be more accurate should be considered correct.

2. **Inspect Closely for Localized Data Inconsistencies.** Selected submissions will be visually checked with the display zoomed-in close enough for a more detailed inspection. At this level of detail, the QC technician can check for any small, localized discrepancies in the integrity, consistency, and accuracy of the data set.
3. **Overlay with Standard Boundary Data to Ensure General Positional Accuracy.** Selected submissions will be overlaid onto a standard base map (such as county boundaries or national highways) to visually check for approximate positional accuracy.
4. **Check for Unexplained Inconsistencies.** In this check, the QC technician will evaluate the shape of the pipeline segments to identify any unexplained changes in direction. For example, a pipeline that doubles back on itself for no reason would be flagged during this check.
5. **Overlay Selected Sections with Scanned Quad Data to Check Detailed Position.** Selected portions of each pipeline system will be overlaid onto a digital quad (if available for that geographical region) to visually check for positional accuracy. The position of pipeline locations, service roads, bodies of water, and other significant physical features will be evaluated relative to the position of the pipeline. **This will be the most detailed check performed.** By thematically shading the QUALITY_CD attribute, the QC technician can evaluate any positional discrepancy.
6. **If There Are Multiple Data Tiles, Check for Edge-Matching.** Any submissions that have been provided on several sheets for a hard-copy submission or in sectional digital submissions should be visually checked for continuous flow across the match-line.
7. **Overlay with Other Repository Data to Check for Conflicts.** Each pipeline system will be overlaid onto other repository data (if available for that geographical region) to visually check for conflicting information. Depending on which repository data is available for the geographic region, thematic shading on some of the pipeline attributes could assist in detecting any conflicts between the two data sets.

Step 6.5 Reporting

Using the NPMS Web Site, the QC Team will compile detailed reports of their findings and activities.

Step 7. Operator Check Plot Review

After the data set has passed the visual screening process and if no errors are found, the QC Team will return the data to the submitting repository, either state or national.

All repositories will be required to produce and return a set of check plots to the submitting operator. At a minimum, the check plots should cover five percent of the submission's mileage, and the areas plotted should be selected at random. Beyond these minimum requirements, states will be free to define their own policies and procedures for fulfilling the check plot requirement.

The National Repository plans to distribute check plots via the Internet. The operator will be sent an access key for this submission via e-mail. Using this access key, the operator will be able to view his/her submission using a standard Web browser. The operator will be able to zoom in and out of the check plot to visually inspect the data and ensure there are no obvious errors that may have gone undetected to this point. If errors are detected, the operator will be able to redline the areas that require correction on-line.

Step 8. Incorporation of the Data into the Master State or National Database

The final step in repository processing is incorporation into the master state or national database. The National Repository will retain two copies of the National NPMS database: a working copy in the Albers projection, and a publication copy un-projected in geographic coordinates. All changes will be made to the working copy. At the end of each work day, the working copy will be checked and re-projected to geographic coordinates. The publication copy will be backed-up and then replaced.

The *Geospatial Data Conversion Tool* will assist the National Repository in completing the following procedures:

1. **State and County Cross Reference.** The NPMS master database will contain tables that cross reference pipeline systems and LNG facilities with the states and counties in which they are located. These tables will be helpful to users who want to make simple geographic queries without the aid of a GIS system. The *Geospatial Data Conversion Tool* will analyze the submission and append the state and county cross reference tables as appropriate.
2. **Forward to States.** If the submission was originally submitted to the National Repository and included data within state repository boundaries,

National Pipeline Mapping System

copies of the submission clipped at state repository boundaries will be created. The submission will be forwarded to the state repository with transmittal information via an interface on the NPMS Web Site.

3. **Incorporate Metadata.** The Microsoft Access metadata file will be distributed to tables into the NPMS master Oracle database. Data will be appended to the primary contact, technical contact, primary metadata, and the source material tables.
4. **Incorporate Geospatial and Attribute Data.** The ARC/INFO line coverage will be appended to the Albers working copy of the master NPMS pipeline and LNG coverages. Pipeline data will be appropriately divided between the pipeline system attribute table and the pipeline segment attribute table. Line topology will be rebuilt.
5. **Check Connectivity.** Each end point of the pipeline system will be visually inspected for proper connectivity to existing data.
6. **Archive.** The operator's original digital files and the submission's final ARC/INFO coverage (.E00) file and metadata data (.MDB) file will be written to tape or other archive device.
7. **Maintain File/Directory.** All directories and files associated with processing the submission will be deleted from the server.

Appendix A

ARC/INFO Geospatial Data Translation Procedures

This section outlines the pseudo-code that will be implemented by the National Repository to manage translating various submission types. According to NPMS standards, multiple data formats are acceptable, and thus must be translated to a common storage format, ARC/INFO.

ARC/INFO .E00:

1. Use IMPORT COVER <in_E00_file> <out_cover>.
2. Check projection information using DESCRIBE <out_cover>.
3. If no projection information exists, use PROJECTDEFINE COVER <out_cover> to define the projection information according to the metadata that came with the coverage.
4. If necessary, reproject using PROJECT COVER <out_cover> <new_cover> to GEOGRAPHIC DD NAD83.

ArcView Shape:

1. Use SHAPEARC <in_shape_file> <out_cover>.
2. Check projection information using DESCRIBE <out_cover>.
3. If no projection information exists, use PROJECTDEFINE COVER <out_cover> to define the projection information according to the metadata that came with the coverage.
4. If necessary, reproject using PROJECT COVER <out_cover> <new_cover> to GEOGRAPHIC DD NAD83.

MicroStation .DGN/Intergraph .MGE:

1. Use IGDSARC <in_igds_file> <out_cover>.
2. Type \$REST at the subcommand prompt.
3. Type Y at the next subcommand prompt.
4. If the feature is a pipeline, relate the coverage's .AAT and .ACODE info tables using RELATE <out_cover_info_file> <join_info_file> <out_cover_info_file> <relate_item>.
5. If the feature is an LNG facility, relate the coverage's .PAT and .XCODE info tables using RELATE <out_cover_info_file> <join_info_file> <out_cover_info_file> <relate_item>.
6. Create line or point topology using BUILD <out_cover> POINT if an LNG facility, or BUILD <out_cover> LINE if a pipeline.
7. Check projection information using DESCRIBE <out_cover>.
8. If no projection information exists, use PROJECTDEFINE COVER <out_cover> to define the projection information according to the metadata that came with the coverage.
9. If necessary, reproject using PROJECT COVER <out_cover> <new_cover> to GEOGRAPHIC DD NAD83.

National Pipeline Mapping System

or

1. In ArcView, load the CAD Reader extension.
2. Read in the .DGN file as a theme.
3. Export the theme as a shapefile.
4. Follow the instructions on converting shapefiles to Arc coverages.

MapInfo .MIF:

1. Use the MIFSHAPE converter utility that comes with ArcView.
2. When asked for the input parameters, specify <LINE | POINT> <in_MIF_file> <out_shape_file>. If converting pipelines, specify the LINE option. For LNG facilities, specify the POINT option.
3. Follow the instructions on converting shapefiles to Arc coverages.

AutoCAD .DWG:

1. In ArcView, load the CAD Reader extension.
2. Read in the .DWG file as a theme.
3. Export the theme as a shapefile.
4. Follow the instructions on converting shapefiles to Arc coverages.

AutoCAD .DXF:

1. Use DXFARC <in_dxf_file.dxf> <out_cover>.
2. Type \$REST at the subcommand prompt.
3. Type Y at the next subcommand prompt.
4. If the feature is a pipeline, relate the coverage's .AAT and .ACODE info tables using RELATE <out_cover_info_file> <join_info_file> <out_cover_info_file> <relate_item>.
5. If the feature is a LNG facility, relate the coverage's .PAT and .XCODE info tables using RELATE <out_cover_info_file> <join_info_file> <out_cover_info_file> <relate_item>.
6. Create line or point topology using BUILD <out_cover> POINT if an LNG facility, or BUILD <out_cover> LINE if a pipeline.
7. Check projection information using DESCRIBE <out_cover>.
8. If no projection information exists, use PROJECTDEFINE COVER <out_cover> to define the projection information according to the metadata that came with the coverage.
9. If necessary, reproject using PROJECT COVER <out_cover> <new_cover> to GEOGRAPHIC DD NAD83.

or

1. In ArcView, load the CAD Reader extension.
2. Read in the DXF file as a theme.
3. Export the theme as a shapefile.
4. Follow the instructions on converting shapefiles to Arc coverages.

Generic:

1. Use GENERATE <out_cover> on a GENERATE-compliant ASCII file containing either line coordinate pairs or point coordinate definitions.
2. At the subcommand prompt, use INPUT <path+ASCII_file>.
3. Next, type LINES or POINTS depending on whether the feature is a pipeline or an LNG facility respectively.
4. Type QUIT.
5. Create line or point topology using BUILD <out_cover> POINT if an LNG facility, or BUILD <out_cover> LINE if a pipeline.
6. Check projection information using DESCRIBE <out_cover>.
7. If no projection information exists, use PROJECTDEFINE COVER <out_cover> to define the projection information according to the metadata that came with the coverage.
8. If necessary, reproject using PROJECT COVER <out_cover> <new_cover> to GEOGRAPHIC DD NAD83.

Intergraph FRAMME:

This sub-section is under development.

Smallworld:

This sub-section is under development.

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Appendix B

*Database Created By The NPMS
Metadata Template As Submitted By Operators*

Appendix B

Database Created By The NPMS Metadata Table As Submitted By Operators

Primary Metadata Table					
Field Name	Field Type	Field Length	Description (acceptable values in bold)	Required Field (Y/N)	Metadata Question Number
Submission Information					
ops_id	Integer	5	Operator ID (validated against OPS database).	Y	–
metadata_id	Character	7	Operator ID + hyphen + two-digit counter (maintained internally).	Y	–
submitDate	Date	8	Date submittal was sent in to the repository.	Y	–
submitCD	Character	25	Reason for submittal: Addition, Spatial Modification, Attribute Modification Only, Metadata Modification Only, Change NPMS Contact Information, Change of Operator Report.	Y	1
spatialSubmitType	Character	10	Type of spatial submittal: Hard-Copy or Digital .	Y	2
descGeneral	Memo	100	General description of submittal.	Y	3
Geospatial Data Quality Information					
upToDate	Character	50	Most current date of pipeline and attribute data.	Y	4
modDate	Character	50	Date modifications were made to pipeline mapping or attributes.	Y	5
changeAware	Character	1	Have any changes been made to pipelines and/or facilities since the data was last modified? (Y/N)	Y	6a
descChanges	Memo	1	Description of changes made to mapping or attribute data that triggered a submission.	N	6b
listStates	Memo	100	List states in which the submitted pipelines reside.	Y	7
qualityCheck	Memo	100	List of any quality checks performed on the pipeline and/or facility data.	Y	8
posAccuracy	Character	50	Positional accuracy of the pipeline and facility data: (E)xcellent = 0 to 50 feet, (V)ery Good = 51 to 300 feet, (G)ood = 301 to 500 feet, (P)oor = 501 to 1000 feet, (U)nknown.	Y	9
determAccuracy	Memo	100	Briefly explain how the positional accuracy was determined.	N	10
Attribute Data Information					
attribQC	Memo	100	Description of any quality control performed on the attribute data.	Y	11
attribIncluded	Character	3	Were attributes included with submission? (Y/N)	Y	12
attribApp	Character	3	Was NPMS application used to create digital attributes? (Y/N)	N	13
attribFile1	Character	20	Attribute data filename.	Y	14
attribFile2	Character	20	Attribute data filename.	N	14
attribFile3	Character	20	Attribute data filename.	N	14
attribFile4	Character	20	Attribute data filename.	N	14
attribFile5	Character	20	Attribute data filename.	N	14
Projection Questions					
datum	Character	50	Datum: NAD27, NAD83, WGS 84, Other.	N	15
mesUnit	Character	50	Units of Measure: Feet, Meters, Miles, Kilometers.	Y	16
projection	Character	50	Projection: Albers, UTM, State Plane, None (LAT/LONG), Other (write in).	Y	17a
stateZone	Character	50	State name and zone number.	N	17b
UTMzone	Character	50	Selected from valid listing for respective projections.	N	17c
projComments	Character	20	Hardware options include: Unix Workstation, NT Workstation, Windows PC, Macintosh, Other.	N	18
Digital Geospatial Data Transmittal Questions					
hardware	Character	20	Computer hardware used to create submission. Unix Workstation, NT Workstation, Windows PC, Macintosh, Other.	N	D19
oper_system	Character	20	Operating system options on which data was created include: Unix, Windows NT, Windows 95/98, Windows 3.1, DOS, MAC OS, Other.	Y	D20
software	Character	20	ARC/INFO, ArcView, Intergraph FRAMME, Intergraph MGE, Intergraph GeoMedia, MicroStation, MGE, Mapinfo, AutoCAD, Smallworld, Other.	Y	D21a
otherSoftwareName	Character	20	Description of other software used.	N	D21b
version	Character	50	Software version number.	Y	D22
digDataFormat	Character	50	E00, SHP, MIF, DWG, DXF, DGN, Generic/Generate.	Y	D23
digMedia	Character	15	Source Media: Online, Diskette, CDROM, ZipDisk.	Y	D24
digFile1	Character	20	Digital submission filename.	Y	D25
digFile2	Character	20	Digital submission filename.	N	D25
digFile3	Character	20	Digital submission filename.	N	D25
digFile4	Character	20	Digital submission filename.	N	D25
digFile5	Character	20	Digital submission filename.	N	D25
Hard-Copy Geospatial Data Transmittal Information					
hardSheets	Integer	3	Number of hard-copy sheets.	Y	H19
hardScale	Character	20	Scale of hard-copy submission: 1:1200 (1" = 100'), 1:2400 (1" = 200'), 1:4800 (1" = 400'), 1:6000 (1" = 500'), 1:12000 (1" = 1000'), 1: 24000 (1" = 2000').	Y	H20

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Operator Contact Table

Field Name	Field Type	Field Length	Description	Required Field (Y/N)	Metadata Question Number
recID	Integer	5	Counter	Y	—
ops_id	Integer	5	Operator ID (validated against OPS database)	Y	—
oper_nm	Character	254	Operator Name	Y	—
repos_code	Character	2	Indicates National Repository (NR) or two-letter state abbreviation	Y	—
p_firstname	Character	25	Primary Contact First Name	Y	—
p_lastname	Character	25	Primary Contact Second Name	Y	—
p_title	Character	25	Primary Contact Title	Y	—
p_companyName	Character	50	Primary Contact Company Name	Y	—
p_address1	Character	50	Primary Contact Address	Y	—
p_address2	Character	50	Primary Contact Address	Y	—
p_city	Character	25	Primary Contact City	Y	—
p_state	Character	2	Primary Contact State	Y	—
p_zipCode	Character	10	Primary Contact Zipcode	Y	—
p_workPhone	Character	30	Primary Contact Work Phone Number	Y	—
p_workExtension	Character	4	Primary Contact Phone Extension	Y	—
p_faxNumber	Character	30	Primary Contact Fax Number	Y	—
p_email	Character	50	Primary Contact Email	Y	—
t_firstname	Character	25	Primary Contact First Name	Y	—
t_lastname	Character	25	Technical Contact Second Name	N	—
t_title	Character	25	Technical Contact Title	N	—
t_companyName	Character	50	Technical Contact Company Name	N	—
t_address1	Character	50	Technical Contact Address	N	—
t_address2	Character	50	Technical Contact Address	N	—
t_city	Character	25	Technical Contact City	N	—
t_state	Character	30	Technical Contact State	N	—
t_zipCode	Character	20	Technical Contact Zipcode	N	—
t_workPhone	Character	30	Technical Contact Work Phone Number	N	—
t_workExtension	Character	2	Technical Contact Phone Extension	N	—
t_faxNumber	Character	10	Technical Contact Fax Number	N	—
t_email	Character	50	Technical Contact Email	N	—

Metadata Source Material Table

Field Name	Field Type	Field Length	Description (acceptable values in bold)	Required Field (Y/N)	Metadata Question Number
sourceMatDescID	Number	2	Counter.	N	—
metadataID	Character	7	Operator ID + hyphen + two-digit counter (maintained internally).	N	—
source	Character	50	Company that created the source material.	N	1
sourceDate	Character	50	Date in YYYY format (can be multiple years).	N	2
hardSubMat	Character	50	Hard-copy source medium: USGS Quad, Ground Survey, GPS Survey, Production Reports.	Y	3
hardPermMat	Character	50	Medium: Paper, Mylar, Vellum, Other (write in).	N	4
sourceDesc	Memo	100	Description of source used to create submission.	N	5
sourceDatum	Character	50	Source datum: NAD27, NAD83, WGS 84, Other.	N	6
sourceScale	Character	50	Scale of Source: 1:1200 (1" = 100'), 1:2400 (1" = 200'), 1:4800 (1" = 400'), 1:6000 (1" = 500'), 1:12000 (1" = 1000'), 1: 24000 (1" = 2000'), Other (write in).	N	7

Note: The primary metadata table has a one-to-one relationship to the operator contact table by the OPS_ID field, and a one-to-many relationship to the metadata source material table by the metadataID field.

Appendix C

NPMS General FGDC Metadata

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National Pipeline Mapping System

Identification Information

Citation

Originator: U.S. Department of Transportation / Baker

Publication Date: 03/30/1999

Title: National Pipeline Mapping System

Publication Information

Publication Place: Washington, D.C.

Publisher: U.S. Department of Transportation, Office of Pipeline Safety

Online Linkage: www.npms.rspa.dot.gov

Description

Abstract: The U.S. Department of Transportation (USDOT), Research and Special Projects Administration (RSPA), Office of Pipeline Safety (OPS) is working with other federal and state agencies and the pipeline industry to create a National Pipeline Mapping System (NPMS). The NPMS is a full-featured geographic information system (GIS) containing the location and selected attributes of the major natural gas transmission lines and hazardous liquid trunklines, and liquefied natural gas (LNG) facilities operating in the United States and other offshore entities. Michael Baker Jr., Inc. (Baker), as the primary contractor, assumes all responsibility of the NPMS National Repository, and is working with NPMS state repositories in California, Texas, Louisiana, Oklahoma, Pennsylvania, New Jersey, Kentucky, Minnesota, and Kansas regarding NPMS database updates, synchronization, and maintenance. Source data is contributed voluntarily by pipeline operators to either a state repository or the National Repository. This metadata is for the entire national dataset. Additional metadata for individual pipeline systems are also available.

Distribution of NPMS data is handled for the OPS by the NPMS National and state repositories. Neither the United States Government nor any party involved in the creation and compilation of NPMS data and maps guarantees the accuracy or completeness of the products. NPMS data has a target accuracy of ± 500 feet and resides in geographic coordinates. NPMS data must never be used as a substitute for contacting the appropriate local one-call center prior to digging.

Purpose: These data sets are for the purpose of tracking all natural gas transmission pipelines, hazardous liquid trunklines, and LNG facilities in the United States. The data will be used to support the assessment risk associated with the Nation's liquid and gas pipeline infrastructure.

Time Period of Content

Range of Dates

Beginning Date: 1999

Ending Date: Ongoing

Currentness Reference: Publication date

Status

Progress: In work

Maintenance and Update Frequency: As needed

Spatial Domain

Bounding Coordinates

West Bounding Coordinate: -179.00

East Bounding Coordinate: -66.00
North Bounding Coordinate: 73.00
South Bounding Coordinate: 18.00

Keywords

Theme

Theme Keyword Thesaurus: None
Theme Keyword: LNG Facility
Theme Keyword: Pipeline
Theme Keyword: Oil
Theme Keyword: Gas
Theme Keyword: Natural Gas

Place

Place Keyword Thesaurus: None
Place Keyword: USA
Place Keyword: United States
Place Keyword: Alabama
Place Keyword: Alaska
Place Keyword: Arkansas
Place Keyword: Arizona
Place Keyword: California
Place Keyword: Colorado
Place Keyword: Connecticut
Place Keyword: Delaware
Place Keyword: District of Columbia
Place Keyword: Florida
Place Keyword: Georgia
Place Keyword: Idaho
Place Keyword: Iowa
Place Keyword: Illinois
Place Keyword: Indiana
Place Keyword: Kansas
Place Keyword: Kentucky
Place Keyword: Louisiana
Place Keyword: Maine
Place Keyword: Massachusetts
Place Keyword: Maryland
Place Keyword: Michigan
Place Keyword: Minnesota
Place Keyword: Missouri
Place Keyword: Mississippi
Place Keyword: Montana
Place Keyword: North Carolina
Place Keyword: North Dakota
Place Keyword: Nebraska
Place Keyword: New Hampshire
Place Keyword: New Jersey
Place Keyword: New Mexico
Place Keyword: Nevada
Place Keyword: New York
Place Keyword: Ohio
Place Keyword: Oklahoma
Place Keyword: Oregon

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Place Keyword: Pennsylvania
Place Keyword: Rhode Island
Place Keyword: South Carolina
Place Keyword: South Dakota
Place Keyword: Tennessee
Place Keyword: Texas
Place Keyword: Utah
Place Keyword: Vermont
Place Keyword: Virginia
Place Keyword: Wisconsin
Place Keyword: Washington
Place Keyword: West Virginia
Place Keyword: Wyoming

Access Constraints: Pipeline operators will be sent back the data they contributed.

Other Freedom of Information Act Requests are under consideration by the USDOT.

Use Constraints: Neither the United States Government nor any party involved in the creation and compilation of NPMS data and maps guarantees the accuracy or completeness of the products. NPMS data should be considered no more accurate than ± 500 feet and must never be used as a substitute for contacting the appropriate local one-call center prior to digging.

Points of Contact

Contact Organization Primary

Contact Organization: U.S. Department of Transportation

Contact Person: Steven Fischer, RSPA

Contact Position: NPMS Coordinator

Contact Address

Address Type: Mailing and physical address

Address: 400 7th Street, SW

City: Washington

State or Province: D.C.

Postal Code: 20590

Country: USA

Contact Voice Telephone: 202-366-6167

Contact Facsimile Telephone: 202-366-4566

Contact Electronic Mail Address: steven.fischer@rspa.dot.gov

Hours of Service: 8am – 5pm EST

Contact Organization Secondary

Contact Organization: Michael Baker Jr., Inc.

Contact Person: Barney Krucoff

Contact Position: NPMS National Repository Manager

Contact Address

Address Type: Mailing and physical address

Address: 3601 Eisenhower Avenue, Suite 600

City: Alexandria

State or Province: VA

Postal Code: 22304

Country: USA

Contact Voice Telephone: 703-960-8800

Contact Facsimile Telephone: 703-960-9125

Contact Electronic Mail Address: npms-nr@mbakercorp.com

Hours of Service: 8am – 5pm EST

National Pipeline Mapping System

Data Quality Information

Attribute Accuracy

Attribute Accuracy Report: The NPMS repositories check all entities and their attribute data for compliance with NPMS data standards. These checks do not ensure that NPMS data accurately reflects conditions in the field – only that the attributes meet database design specifications.

Logical Consistency Report: The National Repository is responsible for ensuring 1) that all geospatial data sets are complete and correctly projected to the proper geodetic datum, and 2) that the attribute data sets are compliant with the NPMS data standards. However, the NPMS is built from voluntary contributions of data from pipeline operators. Operator contributions may vary in many respects; therefore, logical consistency of NPMS data cannot be guaranteed.

Completeness Report: The repository verifies each submitted data set for completeness according to NPMS standards. The repository checks to ensure that all submissions include the geospatial and attribute data, and metadata. However, pipeline operators may submit data to NPMS on a voluntary basis. Pipeline systems that have not been submitted by their operators are not included.

Positional Accuracy

Horizontal Positional Accuracy

Horizontal Positional Accuracy Value: ± 500

Horizontal Positional Accuracy Explanation: Positional accuracy of ± 500 feet has been attempted for all pipelines and LNG facilities. Actual positional accuracy depends on the spatial accuracy of the pipeline operator's submission. Thus, actual positional accuracy of NPMS data varies. Positional accuracy is indicated in the QUALITY_CD field found in both the pipeline and LNG facility attribute tables. Positional accuracy is designated as E, V, G, P, or U where E = Excellent, within 50 feet; V = Very Good, 50–300 feet; G = Good, 301–500 feet; P = Poor, 501–1000 feet; and U = Unknown.

Lineage

Source Information

Source Citation

Originator: Various pipeline operators

Publication Date: Various

Title: Various

Edition: Various

Publication Information

Publication Place: Conterminous United States

Publisher: Various pipeline operators

Online Linkage: www.npms.rspa.dot.gov

Source Scale Denominator: All pipeline and LNG facility data sets submitted to the NPMS by pipeline operators or state repositories for processing are required to originate from scale sources less than or equal to 1:24000. Metadata for individual pipeline systems indicate Source Scale.

Type of Source Media: The NPMS accepts both digital and hard-copy formats for processing data into the NPMS. Metadata for individual pipeline systems indicate Source Media.

Source Time Period of Content Various

Source Currentness Reference: Publication Date

Source Citation Abbreviation: Various

Source Contribution: Various

Process Steps: Listed below

Process Description: The NPMS data compilation process begins when a pipeline or LNG facility operator voluntarily submits data to either a state or the National Repository. Following are eight major steps in the NPMS process:

1. **Operator Submission.** The process will start when an operator sends information (termed “submission”) to an NPMS repository.
2. **Repository Check-In.** Repositories will log, scan digital submissions for viruses, inventory submissions, notify operator of submission receipt, and initiate tracking procedures. Tracking will be a cooperative effort between the state repositories and the National Repository.
3. **Metadata Review and Repair.** The metadata file(s) that accompanies a submission is extremely important because it serves as a transmission form as well as the metadata. Various NPMS applications, particularly the *Geospatial Data Conversion Tool*, will depend on information from the metadata to complete processing in an automated manner. If problems exist with the metadata, repositories will work with the operator to complete the submission. The submission will then be routed for the necessary processing.
4. **Hard-Copy and Digital Data Conversion.** Submissions with hard-copy geospatial data will be separated from submissions with digital geospatial data. Hard-copy submissions will be digitized, and digital submissions will be translated. Attribute data will be matched to the appropriate line features and reviewed for compliance with the standards. At the end of this step, the data will be in ARC/INFO format and ready for final processing.
5. **Interstate Processing.** The state repositories and the National Repository will work together to assign NPMS_SYS_IDs and coordinate interstate edge-matching, completing the final processing. States that collect more data than the NPMS requires, or that have a different storage scheme, must bring their data into compliance with national standards at this stage.
6. **Quality Assurance and Quality Control.** An independent quality control review will be performed by the National Repository Quality Control Team.
7. **Operator Check Plot Review.** The repository that originally received the submission will prepare a random selection of check plots for review by the submitting operator. The operator will be asked to review and comment on the check plots. The National Repository intends to distribute check plots via an Internet map server application. State repositories will be free to distribute check plots by the most appropriate means.
8. **Incorporation of the Data into the Master State or National Database.** The repositories will incorporate the data into their master database. If the submission was originally sent to the National

National Pipeline Mapping System

Repository, the state may have to collect additional information to meet its requirements at this time.

Process Date: Ongoing

Process Contact

Contact Organization Primary

Contact Organization: Michael Baker Jr., Inc.

Contact Person: Barney Krucoff

Contact Position: NPMS National Repository Manager

Contact Address

Address Type: Mailing and physical address

Address: 3601 Eisenhower Avenue, Suite 600

City: Alexandria

State or Province: VA

Postal Code: 22304

Country: USA

Contact Voice Telephone: 703-960-8800

Contact Facsimile Telephone: 703-960-9125

Contact Electronic Mail Address: npms-nr@mbakercorp.com

Hours of Service: 8am – 5pm EST

Spatial Data Organization Information

Indirect Spatial Reference: Conterminous United States

Direct Spatial Reference Method: Vector, Point

Point and Vector Object Information

SDTS Terms Description

SDTS Point and Vector Object Type: Point, Entity Point, Label Point, Node.

Point and Vector Object Count: Changes on an on-going basis.

National Pipeline Mapping System

Spatial Reference Information

Horizontal Coordinate System Definition

Geographic

Latitude Resolution: 0.000001

Longitude Resolution: 0.000001

Geographic Coordinate Units: Decimal Degrees

Geodetic Model

Horizontal Datum Name: North American Datum 1983 (NAD83)

Ellipsoid Name: Geodetic Reference System 80 (GRS80)

Semi-Major Axis: 6,378,137

Denominator of Flattening Ratio: 298.257

Entity and Attribute Information

Detailed Description

Entity Type

Entity Type Label: Pipeline

Entity Type Definition: Polyline of pipeline segments.

Entity Type Definition Source: Pipeline Segment Attribute Table and Pipeline System Attribute Table

Attributes

Attribute Label: NPMS_SEG_ID

Attribute Definition: Identifier for the polyline segment. Assigned automatically by ARC/INFO when line topology is built.

Attribute Definition Source: NPMS

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: 1 – 9999999999

Enumerated Domain Value Definition: Any number 11 characters in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: 1

Attribute Label: NPMS_SYS_ID

Attribute Definition: Unique link between the geospatial elements (lines) and their respective attribute records. Assigned by the National Repository.

Attribute Definition Source: NPMS

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: 1 – 99999999

Enumerated Domain Value Definition: Any number eight characters in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: 1

Attribute Label: SUBSYS_NM

Attribute Definition: A name for a smaller subsection of a pipeline system. A subset of SYS_NM.

Attribute Definition Source: OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: Free text

Enumerated Domain Value Definition: Any string 40 characters in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

National Pipeline Mapping System

Attribute Label: PLINE_ID

Attribute Definition: Unique identifier for a specific section of pipeline within a pipeline system.

Attribute Definition Source: OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: Free text

Enumerated Domain Value Definition: Any string 20 characters in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: OPS_ID

Attribute Definition: Accounting number assigned by the OPS to the company that operates the pipeline system.

Attribute Definition Source: NPMS

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: 1 – 99999

Enumerated Domain Value Definition: Any number 5 characters in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: 1

Attribute Label: OPER_NM

Attribute Definition: Name of the company that operates the pipeline.

Attribute Definition Source: NPMS

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: Free text

Enumerated Domain Value Definition: Any string 40 characters in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: SYS_NM

Attribute Definition: Name for a functional grouping of pipelines.

Attribute Definition Source: NPMS

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: Free text

Enumerated Domain Value Definition: Any string 40 characters in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: DIAMETER

Attribute Definition: Nominal diameter of the pipeline segment.

Attribute Definition Source: OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: 01.00 – 99.00

Enumerated Domain Value Definition: Any real 4 characters in length with 2 decimal places.

Attribute Units of Measurement: Inches

Attribute Measurement Resolution: 0.01

Attribute Label: COMMODITY1

Attribute Definition: Abbreviation for the primary commodity carried by the pipeline.

Attribute Definition Source: OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: HG, CRD, LPG, NG, PRD, AA, CO2, NGL, HVL, EMT

Enumerated Domain Value Definition: HG = Hydrogen Gas, CRD = Crude Oil, LPG = Liquid Petroleum Gas, NG = Natural Gas, PRD = Product, AA = Anhydrous Ammonia, CO2 = Carbon Dioxide, NGL = Natural Gas Liquids, HVL = Highly Volatile Liquid, EMT = Empty

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: COMMODITY2

Attribute Definition: Abbreviation for the secondary commodity carried by the pipeline.

Attribute Definition Source: OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: HG, CRD, LPG, NG, PRD, AA, CO2, NGL, HVL

Enumerated Domain Value Definition: HG = Hydrogen Gas, CRD = Crude Oil, LPG = Liquid Petroleum Gas, NG = Natural Gas, PRD = Product, AA = Anhydrous Ammonia, CO2 = Carbon Dioxide, NGL = Natural Gas Liquids, HVL = Highly Volatile Liquid

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

National Pipeline Mapping System

Attribute Label: COMMODITY3

Attribute Definition: Abbreviation for the tertiary commodity carried by the pipeline.

Attribute Definition Source: OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: HG, CRD, LPG, NG, PRD, AA, CO2, NGL, HVL

Enumerated Domain Value Definition: HG = Hydrogen Gas, CRD = Crude Oil, LPG = Liquid Petroleum Gas, NG = Natural Gas, PRD = Product, AA = Anhydrous Ammonia, CO2 = Carbon Dioxide, NGL = Natural Gas Liquids, HVL = Highly Volatile Liquid

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: CMDTY_DESC

Attribute Definition: Descriptive information on the commodities carried by the pipeline system.

Attribute Definition Source: OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: Free text

Enumerated Domain Value Definition: The name of each commodity carried separated by commas, 40 characters in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: INTERSTATE

Attribute Definition: Designator to identify whether the pipeline is an interstate pipeline.

Attribute Definition Source: OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: N, Y

Enumerated Domain Value Definition: N = No, Y = Yes

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: STATUS_CD

Attribute Definition: Identifies the current status of the pipeline segment.

Attribute Definition Source: OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: I, B, R

Enumerated Domain Value Definition: I = In Service, B = Abandoned, R = Retired

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: QUALITY_CD

Attribute Definition: Operator's estimate of the positional accuracy of the submitted pipeline data.

Attribute Definition Source: OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: E, V, G, P, U

Enumerated Domain Value Definition: E = Excellent, within 50 feet; V = Very Good, 50–300 feet; G = Good, 301–500 feet; P = Poor, 501–1000 feet; U = Unknown

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: REVIS_CD

Attribute Definition: Identifies pipeline as an addition, or a modification to or deletion of a previous submission.

Attribute Definition Source: NPMS/OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: A, M, D

Enumerated Domain Value Definition: A = Addition, M = Modification, D = Deletion

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: METADATA_ID

Attribute Definition: Identifier to link geospatial and metadata tables together.

Attribute Definition Source: NPMS

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: 1 – 99999999

Enumerated Domain Value Definition: Any string 12 characters in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

National Pipeline Mapping System

Attribute Label: SUBREPOSCD

Attribute Definition: Two-letter code that identifies the repository that processed the data.

Attribute Definition Source: NPMS

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: NR, CA, TX, KS, OK, LA, NJ, PA, MN, KY

Enumerated Domain Value Definition: NR = National Repository, CA = California Repository, TX = Texas Repository, KS = Kansas Repository, OK = Oklahoma Repository, LA = Louisiana Repository, NJ = New Jersey Repository, PA = Pennsylvania Repository, MN = Minnesota Repository, KY = Kentucky Repository

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Entity Type

Entity Type Label: LNG_Facility

Entity Type Definition: Point representation of Liquefied Natural Gas (LNG) facilities.

Entity Type Definition Source: LNG Facility Attribute Table

Attributes

Attribute Label: NPMS_SYS_ID

Attribute Definition: Unique link between the geospatial elements (points) and their respective attribute records. Assigned by the National Repository.

Attribute Definition Source: NPMS

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: 1 – 99999999

Enumerated Domain Value Definition: Any integer eight characters in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: 1

Attribute Label: OPS_ID

Attribute Definition: Accounting number assigned by the OPS to the company that operates the LNG facility.

Attribute Definition Source: NPMS

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: 1 – 99999

Enumerated Domain Value Definition: Any positive integer five characters in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: 1

Attribute Label: OPER_NM

Attribute Definition: Name of the company that operates LNG facility.

Attribute Definition Source: NPMS

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: Free text

Enumerated Domain Value Definition: Any string 40 characters in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: LNG_NM

Attribute Definition: LNG facility name.

Attribute Definition Source: OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: Free text

Enumerated Domain Value Definition: Any string 40 characters in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: LNG_ID

Attribute Definition: Identifier for the LNG facility assigned by the operator.

Attribute Definition Source: OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: Free text

Enumerated Domain Value Definition: Any string 20 character in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: STATUS_CD

Attribute Definition: Identifies the current status of the LNG facility.

Attribute Definition Source: OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: I, B, R

Enumerated Domain Value Definition: I = In Service, B = Abandoned, R = Retired

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

National Pipeline Mapping System

Attribute Label: QUALITY_CD

Attribute Definition: Operator's estimate of the positional accuracy of the submitted LNG facility data.

Attribute Definition Source: OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: E, V, G, P, U

Enumerated Domain Value Definition: E = Excellent, within 50 feet; V = Very Good, 50–300 feet; G = Good, 301–500 feet; P = Poor, 501–1000 feet; U = Unknown

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: REVIS_CD

Attribute Definition: Identifies LNG facility as an addition, or a modification to or deletion of a previous submission.

Attribute Definition Source: NPMS/OPERATOR

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: A, M, D

Enumerated Domain Value Definition: A = Addition, M = Modification, D = Deletion

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: METADATA_ID

Attribute Definition: Identifier to link geospatial and metadata tables together.

Attribute Definition Source: NPMS

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: 1 – 99999999

Enumerated Domain Value Definition: Any string 12 characters in length.

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

Attribute Label: SUBREPOSCD

Attribute Definition: Two-letter code that identifies the repository that processed the data.

Attribute Definition Source: NPMS

Attribute Domain Values

Enumerated Domain

Enumerated Domain Value: NR, CA, TX, KS, OK, LA, NJ, PA, MN, KY

Enumerated Domain Value Definition: NR = National Repository, CA = California Repository, TX = Texas Repository, KS = Kansas Repository, OK = Oklahoma Repository, LA = Louisiana Repository, NJ = New Jersey Repository, PA = Pennsylvania Repository, MN = Minnesota Repository, KY = Kentucky Repository

Attribute Units of Measurement: N/A

Attribute Measurement Resolution: N/A

National Pipeline Mapping System

Distribution Information

Distributor

Contact Organization Primary

Contact Organization: Michael Baker Jr., Inc.

Contact Person: Barney Krucoff

Contact Position: NPMS National Repository Manager

Contact Address

Address Type: Mailing and physical address

Address: 3601 Eisenhower Avenue, Suite 600

City: Alexandria

State or Province: VA

Postal Code: 22304

Country: USA

Contact Voice Telephone: 703-960-8800

Contact Facsimile Telephone: 703-960-9125

Contact Electronic Mail Address: npms-nr@mbakercorp.com

Hours of Service: 8am – 5pm EST

Resource Description: The NPMS contains natural gas transmission lines, hazard liquid trunklines, and LNG facilities in the United States. Only those pipelines that have been voluntarily submitted by facility operators are included in the data set.

Distribution Liability: Use at your own risk. NPMS maps and/or digital data have been compiled by the United States Department of Transportation, Research and Special Programs Administration, Office of Pipeline Safety as part of the National Pipeline Mapping System (NPMS). The data is compiled from contributions made by pipeline and LNG facility operators and is processed by state agencies and private contractors. Neither the United States Government nor any party involved in the creation and compilation of NPMS data and maps guarantees the accuracy or completeness of the product. NPMS data should be considered no more accurate than ± 500 feet and must never be used as a substitute for contacting the appropriate local one-call center prior to digging.

Standard Order Process

Digital Form: Contact an NPMS state repository or the National Repository for available formats and media.

Online Option

Computer Contact Information

Network Address

Network Resource Name: www.npms.rspa.dot.gov

Metadata Reference Information

Metadata Date: 03/30/1999

Metadata Contact

Contact Organization Primary

Contact Organization: Michael Baker Jr., Inc.

Contact Person: Barney Krucoff

Contact Position: NPMS National Repository Manager

Contact Address

Address Type: Mailing and physical address

Address: 3601 Eisenhower Avenue, Suite 600

City: Alexandria

State or Province: VA

Postal Code: 22304

Country: USA

Contact Voice Telephone: 703-960-8800

Contact Facsimile Telephone: 703-960-9125

Contact Electronic Mail Address: npms-nr@mbakercorp.com

Hours of Service: 8am – 5pm EST

Metadata Standard Name: FGDC Content Standards for Digital Geospatial Metadata

Metadata Standard Version: Version 2.0

Metadata Time Convention: Eastern Standard Time (EST)

Metadata Access Constraints: None

Metadata Use Constraints: None

